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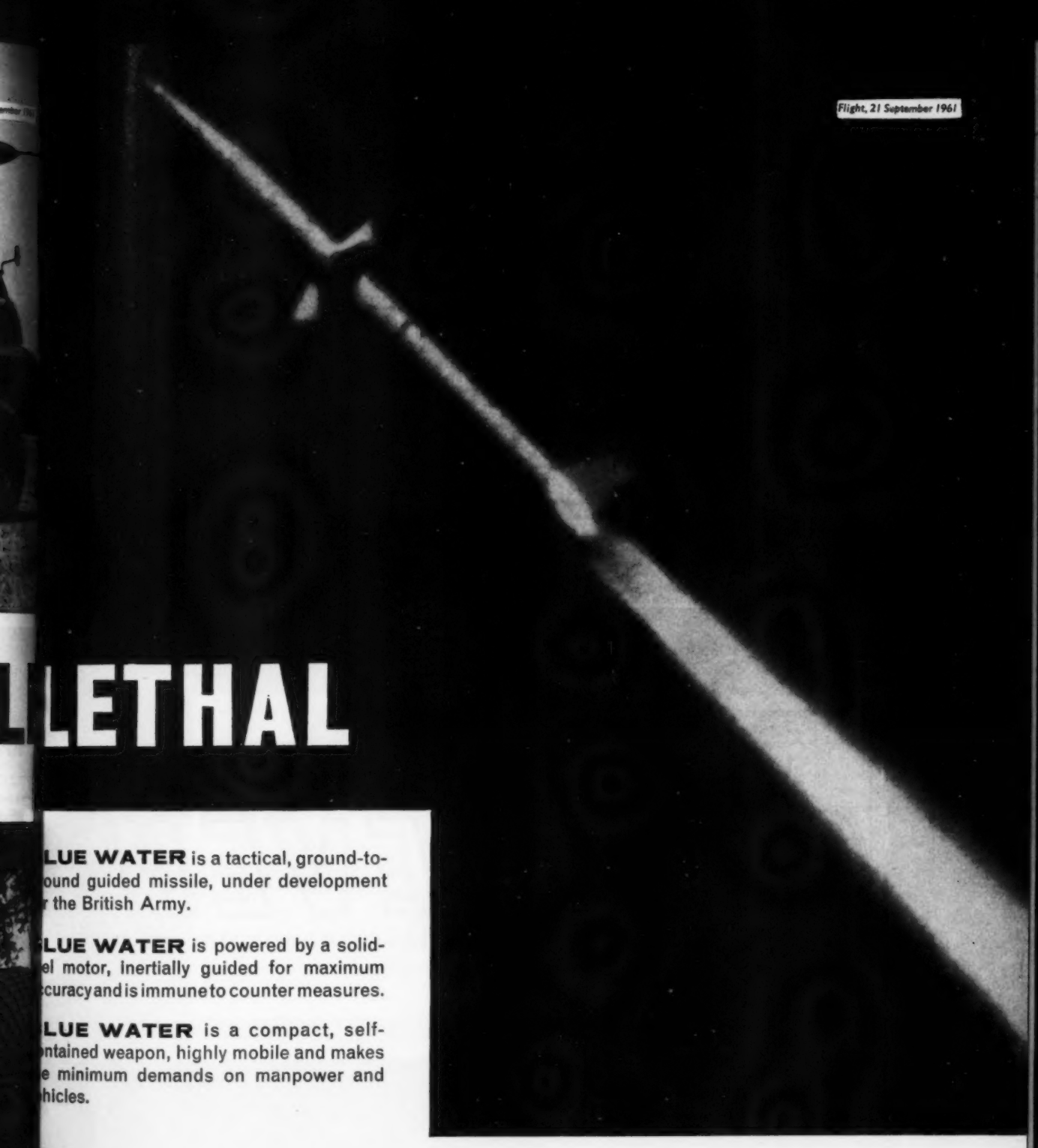

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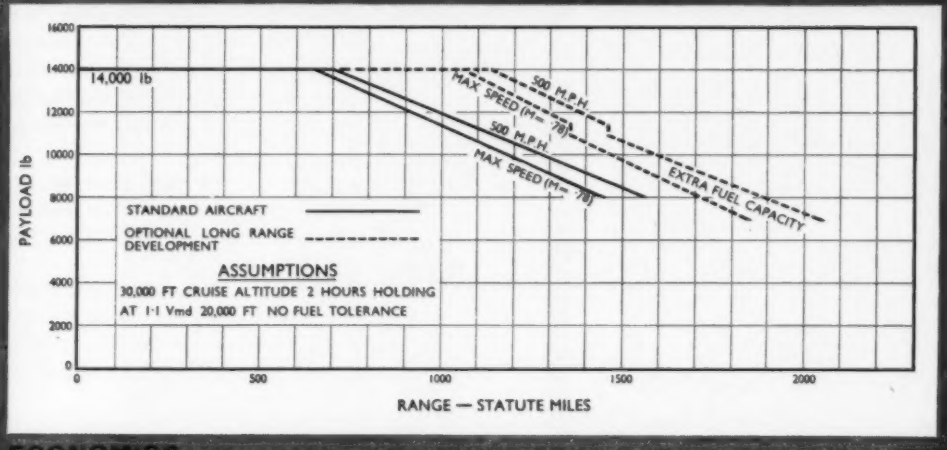

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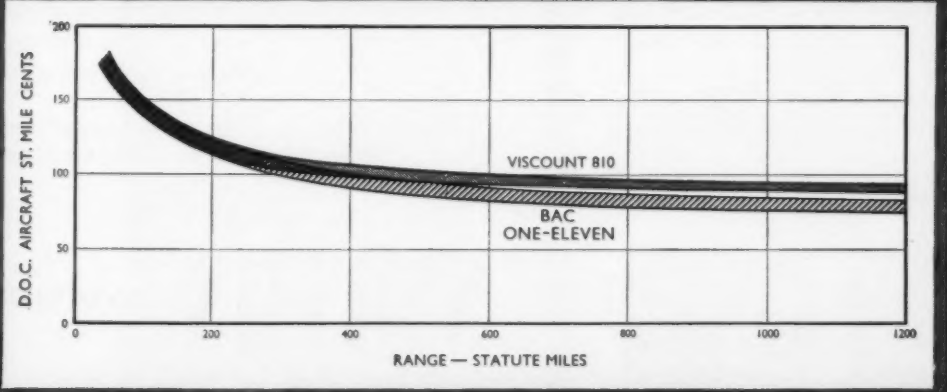

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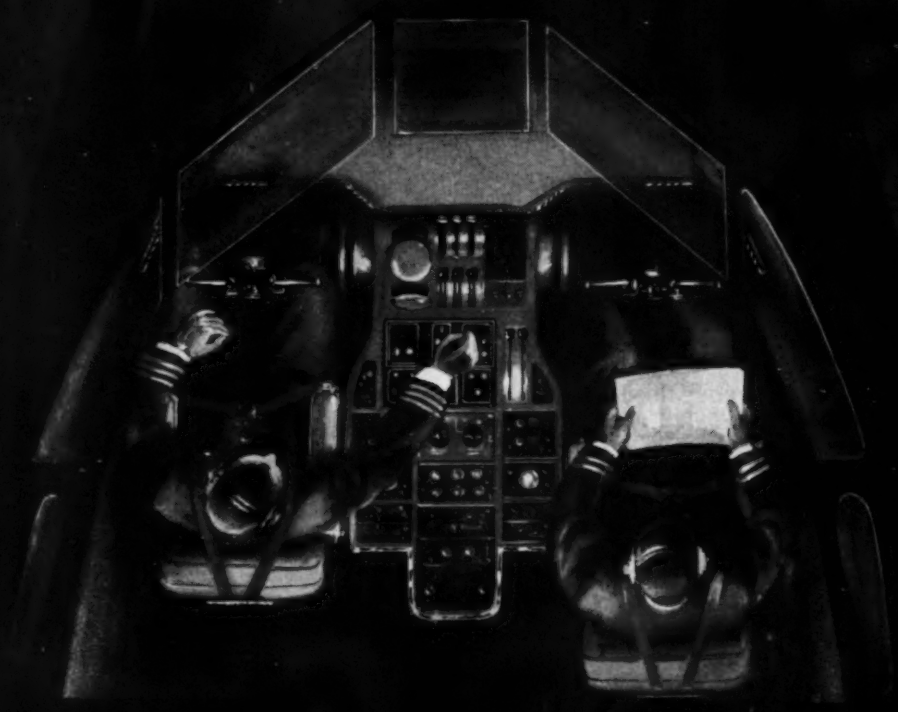

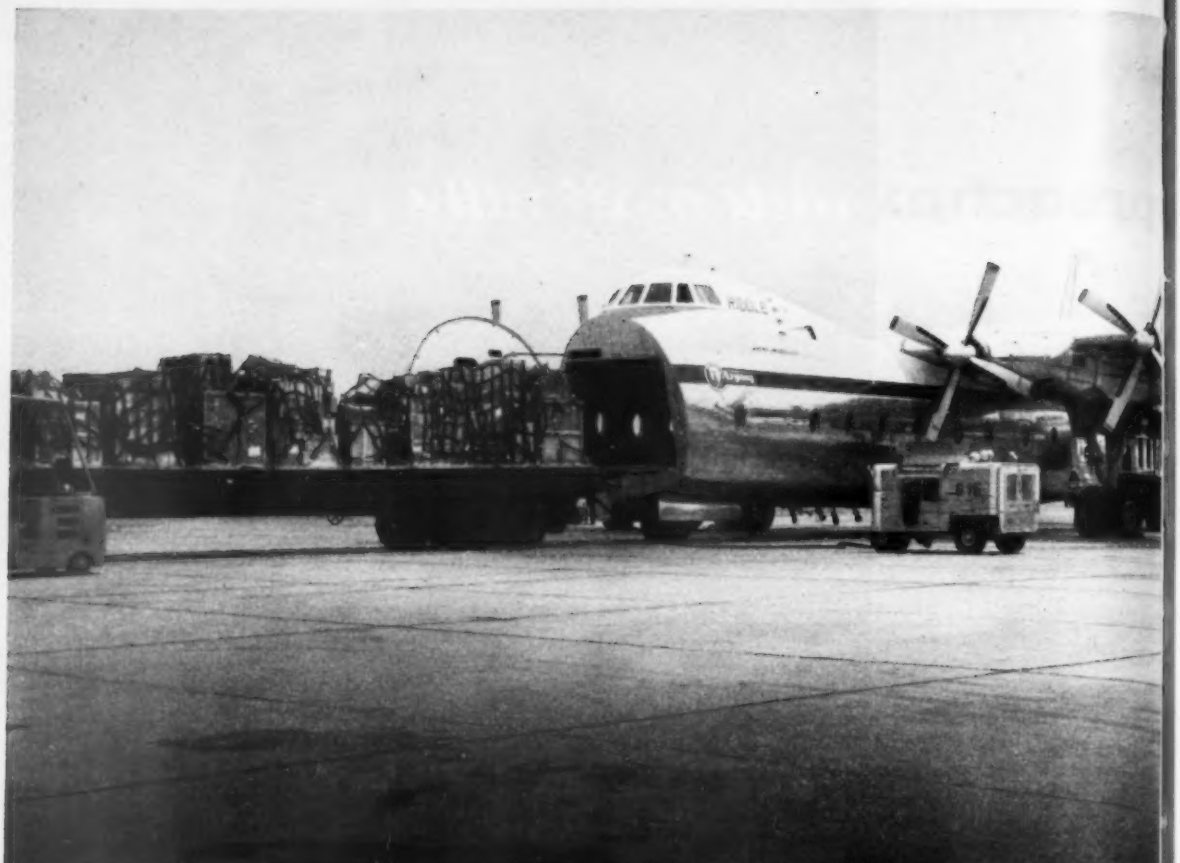

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No 2741 VOLUME 80 THURSDAY 21 SEPTEMBER 1961

FLIGHT

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded in 1909

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Iliffe Transport Publications Ltd, Dorset House, Stamford Street, London, SE1; telephone Waterloo 3333. Telegrams Flightpres London SE1. Annual subscriptions: Home £4 15s. Overseas £5. Canada and USA $15.00. Second Class Mail privileges authorized at New York, NY.

Branch Offices Coventry: 8-10 Corporation Street; telephone Coventry 25210. Birmingham: King Edward House, New Street, 2; telephone Midland 7191. Manchester: 260 Deansgate 3; telephone Blackfriars 4412 or Deansgate 3595. Glasgow: 62 Buchanan Street C1; telephone Central 1265-6.

New York, NY: Thomas Skinner & Co (Publishers) Ltd, 111 Broadway 6; telephone Digby 9-1197.

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BEA in the Balance

VERY soon now—perhaps within the next two or three weeks—the Air Transport Licensing Board will announce decisions of far-reaching consequence for Britain's air transport industry. By this time the Board will have weighed the million words spoken for and against the independent operators' applications, lodged mainly by British United and Cunard Eagle, for seventy-odd new European and United Kingdom domestic routes.

The party with the most at stake is BEA, who can gain little and lose much. The independents can lose nothing, and could gain a great deal.

Two instincts are aroused by the corporation *v.* independent contests which, since last spring, have been taking place in the courtroom of the Board at Therese House. Instinct number one is to stick up for the little man—for the David who challenges the state Goliath. Instinct number two is to see fair play. There is something to be said for judgments based on these instincts, emotional though they may be; but in the context of British air transport these two characteristically British instincts are in conflict.

The Goliath in the particular case now being reviewed by the Board is not the Philistine baddie but a valuable and consistently profitable national asset, and one of the world's most progressive airlines. People who incline towards fair play must have found themselves wondering how fair it is that this highly successful airline, which has more expertise in the business of air transport than all the independents put together, should be obliged to appear in court as a defendant. BEA has nothing to defend but a first-class record of public service. It is possible to pick holes in some of its commercial practices, and criticism—particularly public criticism—is the stuff of which improvement is made. But so far as the achieved record is concerned (and this is all that really counts) critics of BEA are not to be found.

A Chance for the Independents

By all means give the little men a reasonable chance—a chance to prove their worth, to improve and expand their business, and to provide the stimulus which a governing party always derives from the knowledge that, should it falter or fail, an alternative party is always ready to assume power. But it would be folly to undermine BEA's hard-won position (and to demoralize the spirit that achieved it) by wholesale, or even substantial, acquiescence with the independents' desires.

Judgments based on instincts alone can, of course, be very wrong. So indeed can judgments based solely on traffic statistics, on intergovernmental air agreements, on the definition of words in the Act like "material diversion," or on any of the economic and political technicalities aired with such skill and persuasion by the advocates and counsel of both sides for hour after hour. Certainly the Board lacks nothing in the way of documentation and statistics; it has mountains of evidence to analyse and to consider before it finally reaches its decisions.

If, in the event, only a mouse is born in the way of licences granted, the Board's reasons for its decisions will nevertheless contribute significantly to the case law that will influence future applications and objections. Like the Athenians who waited with awe for the Delphic oracle to answer their questions to the gods, our air transport industry now awaits the Board's verdict on the most portentous of its hearings to date.

FROM ALL QUARTERS

BAC Changes

THREE new British Aircraft Corporation appointments, taking effect from October 1, were announced last week. Sir George Edwards becomes managing director and Lord Caldecote deputy managing director and chief executive (guided weapons); Marshal of the RAF Sir Dermot Boyle is to undertake special responsibilities for co-ordinating administration of personnel and training. Sir George was made executive director (aircraft) and Lord Caldecote executive director (guided weapons) in May last year; Sir Dermot, former Chief of the Air Staff, was appointed to the corporation's board in March.

Sir George Edwards will now cease to be managing director of Vickers-Armstrongs (Aircraft), instead becoming deputy chairman. He is being succeeded as managing director by Mr A. W. E. Houghton, assistant managing director since May 1.

CL-41s for the RCAF

A DECISION by the Canadian Government to procure for the RCAF the Canadair CL-41 as a basic jet trainer was announced last week, when the aircraft was on a sales demonstration tour in Europe. In his announcement, the Minister of National Defence, the Hon. D. S. Harkness, said that the RCAF "had tested and evaluated most of the training aircraft available in the Western world before making its decision." The CL-41 was the subject of an "in the air" article in *Flight* for September 7.

More Autopilots for Germany

SHORTLY after the SBAC Show, Smiths Aviation Division were able to announce a follow-on order from Germany for SEP.2 autopilots and flight and engine instruments to be fitted in German Air Force Noratlas transports. Equipment of this type was originally standardized for the Noratlas in 1958, and the new order is worth £190,000. As reported in *Flight* last week, Smiths are also supplying an SEP.4B Autoland system for German evaluation in a Noratlas.

Conference Ends

MESSAGES from the Queen, President Kennedy and Prince Philip were read by the respective presidents of the Royal Aeronautical Society, Institute of the Aerospace Sciences and Canadian Aeronautical Institute on September 14, at the London dinner which marked the end of the eighth Anglo-American Aeronautical Conference. The Duke of Edinburgh's message stated, "We are living in a period of very rapid progress in the aeronautical and space sciences. Frequent discussion between people engaged in this work is essential if full advantage is to be taken of the widespread research effort. I am sure that this conference will give rise to much new thinking."

At the final session of the conference earlier the same day, Air Marshal Sir Owen Jones, RAeS president, said that the three-subject approach—concentrating on space research, supersonic transports and VTOL aircraft—had proved a popular choice. The papers had, in the speaker's opinion, achieved the right level between the extra-specialized type of lecture and the too-broad review. The time available for discussion of papers invariably had been too short, the air-conditioning in the new lecture hall "must be improved," and the catering "has not been up to my hopes," but it had nonetheless been a good conference.

VK-5s for the HF-24?

ACCORDING to the *Interavia Air Letter* (September 12), the Indian Defence Ministry is said to have decided to adopt a Russian powerplant for the Hindustan HF-24 supersonic fighter. The propulsion of this aircraft has been a thorn in Bristol Siddeley's side for some considerable time. The prototype is flying with two Orpheus 703s, which are essentially 803s with an air-turbine starter. Production (supersonic) HF-24s could probably have a reheat version of this engine, which would have to be specially tailored to the installation. A more efficient solution would be two Orpheus BOr.12s, but the absence of a home market for this engine—the NATO Breguet Taon having been overtaken by events—means that the development charges would have to be met either by Bristol Siddeley or by the Indian Government.

Now, according to *Interavia Air Letter*, the Indians have bought six Klimov VK-5 engines, for installation in the third and fifth HF-24 development aircraft. The VK-5 is a highly developed axial engine, reported to be rated at 8,818lb dry. Afterburning versions are in very wide service in the Mig-19, and the VK-5 is also probably the powerplant of the earlier versions of the Yak-25 fighter/bomber. If true, this is the first aero-engine to have been exported from Russia.

Fokker's Irish Recruits

WITH a backlog of orders worth many millions of pounds and a shortage of skilled labour, like most Dutch engineering employers, Fokker put their first intake of British craftsmen to work last week. The first party of 13 are all Belfast men recruited last month. All were previously unemployed, having been victims of the redundancy afflicting aircraft and shipbuilding in Northern Ireland. More have been recruited and are due shortly at Schiphol.

Their reception at Fokker has pleased the recruits and they are delighted to find that many of the company's workers speak English. Fokker are, however, arranging Dutch language classes for the Irishmen and technical phrase books have been prepared to assist them in their daily work. As all Fokker drawings are detailed in English, however, they have experienced little difficulty.

Fokker's recruiting efforts in Northern Ireland and other parts of the United Kingdom are continuing, the company having been heartened by the results of its first recruiting campaign, which began only on August 15. Together with the special contracting agreement with the French company, Louis Breguet, announced recently, the need to recruit abroad is dictated by the need to keep French production running at its present rate while work on Fokker's major military commitment, the F-104G Starfighter, increases.

PRESENTATIONS of Royal Aeronautical Society honours and awards were made, as is customary, on the evening of the Wilbur Wright Lecture. In these "Flight" photographs the president, Air Marshal Sir Owen Jones, is seen making the presentations, the recipients—from left to right in each set of pictures—being as follows:—

Right: Sir Sydney Camm, Honorary Fellowship; J. D. North, Honorary Fellowship; J. N. Toothill, Honorary Companionship.

Below: Raoul Hafner, RAeS Silver Medal (the Society's Gold Medal has not been awarded this year); L. Haworth, RAeS Bronze Medal; Dr S. G. Hooker, British Gold Medal for Aeronautics; M. Escolla, receiving the British Silver Medal for Aeronautics on behalf of M Pierre Satre (unable to be present) with whom, together with M Duguet, he collaborated in the conception of the Caravelle.

Opposite page: Dr E. Eastwood, Wakefield Gold Medal; R. P. Dickinson, R. P. Alston Medal; J. Wilding, N. E. Rowe Medal (21-26 age group); W. Bishop, N. E. Rowe Medal (under-21 age group); and Jack Brannon, Alan Marsh Medal. The Alan Marsh Award was presented to M. S. Eden, not portrayed here.

Citations for the honours and awards, together with details of the posts held by the recipients, were given in "Flight" for May 18 (page 655) and May 25 (page 687).

STARRED ROUNDEL on the fuselage of this de Havilland Dove 7 signifies the United Arab Republic, to whose Air Force representative, Air Marshal M. N. Hashad (centre), the aircraft was handed over on September 7. Based at Cairo, it will be used for surveying desert sites suitable for agricultural or industrial development. With the Air Marshal were Wg Cdr Hossam Ghoniem (right) and Wg Cdr Joseph Hafez, who were ferrying the Dove from Hatfield

Cranfield Symposium

THE place of aeronautics in the national economy was a main theme of a two-day symposium organized by the Cranfield Society, the association of former students of the College of Aeronautics, Cranfield, on September 16-17 at the College. Under the broad heading *Key Problems in Aeronautics*, the discussion centred on long-term technical and economic planning in different fields.

Among the main speakers at the meeting were Mr William Littlewood, vice-president (equipment research) of American Airlines; Dr T. P. Wright, chairman of the board of directors of Cornell Aeronautical Laboratories; Mr Bo Lundberg, director-general of the Swedish Aeronautical Research Institute; Mr Robert L. Lickley, managing director of Folland Aircraft and acting managing director of Hawker Aircraft; Sir Geoffrey Tuttle, general manager of Vickers-Armstrongs (Aircraft) Ltd; Mr M. B. Morgan of the Ministry of Aviation and Mr A. J. Lucking of the Bow Group.

Others who contributed to the weekend's discussions included Mr Peter Brooks and Mr John Seekings of BEA, Mr Ralph Cohen of IATA, Mr R. A. Courtman of de Havilland Aircraft, Mr A. V. Cleaver of Rolls-Royce and Prof A. V. Stephens of Queen's University, Belfast.

IN BRIEF

A detachment of Lightnings from 56 Sqn visited RAF Bruggen, Germany, on September 18. This was the first of a number of detachments to Germany being made by Lightnings of RAF Fighter Command.

Two Republic F-84s of the West German Air Force landed at Tegel Airport in the French sector of Berlin on September 14. It was stated that they had lost their way while on an exercise. They were given permission to land because of shortage of fuel.

The Scottish National Parachute Jumping Competitions, being held at Perth Aerodrome tomorrow (September 22) and on Saturday, have attracted some 50 entries. The public will be admitted on Saturday (by programme, price 2s 6d).

Capt Maurice Luby, BSC, MIMECHE, FRAES, RN(Retd), has been appointed research director of High Duty Alloys Ltd, a company in the Hawker Siddeley Group. He was formerly vice-chairman and general manager of Rotax Ltd, from 1952 onwards, having previously been with the MoS as Director of Engine Research and Development and chairman of the Gas Turbine Collaboration Committee.

The annual dinner of the Rotorcraft Section of the Royal Aeronautical Society was held in London on Wednesday of last week and followed the informal and friendly pattern set in previous years. The vice-chairman, Wg Cdr R. A. C. Brie, took the chair in the absence in America of the president, Prof J. A. J. Bennett. Chief guests were Maj-Gen G. P. L. Weston, Director of Land/Air Warfare, and Dr Guyford Stever, president of the American Institute of Aerospace Sciences.

Mr F. B. Greatrex, MA, FRAES, AMIEE, assistant chief engineer (staff engineering) of the Rolls-Royce Aero Engine Division, has been awarded the Wright Brothers Medal for 1960 by the American Society of Automotive Engineers. He will receive it at the SAE National Aeronautic Meeting at Los Angeles in October. The award was made for the paper *By-pass Engine Noise*, presented by Mr Greatrex last year at the SAE National Aeronautic Meeting in New York.

REMEMBERING THE BATTLE

NOW-TRADITIONAL ceremonies and spectacles marked the commemoration last weekend of the Battle of Britain. On Sunday there was a service of thanksgiving in Westminster Abbey, followed by a march-past along the Victoria Embankment, past the Air Forces Memorial and the recently unveiled statue of Marshal of the RAF Lord Trenchard. The salute was taken by Marshal of the RAF Lord Newall, Chief of the Air Staff in 1940. There was to have been a fly-past, in which Lightnings of Fighter Command were taking part for the first time; but low cloud, rain and mist compelled a cancellation.

Few meteorological troubles affected the "at homes" held at RAF stations on the Saturday, however, when conditions were splendid alike for spectators and participants (exceptions were at airfields affected by high winds: at Valley, Anglesey, for instance, gusts of up to 55kt caused cancellation of a number of items). Total attendance at 16 stations was 906,500, as against 766,500 at 25 stations open last year. Largest attendance—180,000—was as usual at Biggin Hill, now no longer an operational base for Service flying, but used annually by Air Ministry for this event. Only airfield "at home" in the London vicinity, it is also perhaps the most famous of those associated with the Battle of Britain.

Last Saturday's flying display there included the return of the Hurricane and "Spit" to the station which knew them so well. Their modern equivalents, Hunters and Lightnings, contributed the usual polished formation aerobatics by 92 and 74 Sqns. "Route" aircraft came and went exactly on time—three Lincolns of Signals Command, a Valiant, a pair of Voodoos and the USAF Skyblazers trailing their shock-diamonds. Flying conditions—bright sun and high wind—made the light-aircraft items more thrilling than was intended. The pilot of an army AOP.9 who went under a 20ft tape was to be particularly commended, as was the "box" man in the CFS Jet Provost team.

Earlier in the day the technical exhibits in the parachute-draped hangars had been well patronized; the guns at the butts were in constant use and the gathering crowd had been entertained by a team of Metropolitan Police motor cyclists defying all the known laws.

Another typical display was at Waterbeach, Cambs, home base of Nos 25 and 64 Sqns, both of which are equipped with Javelin FAW.9s. Eight-eighths blue prevailed, but the wind, gusting at ground level to 35kt, caused the cancellation of a parachute drop and two in-flight refuelling demonstrations.

Excellent solo displays came from a Jet Provost, Vampire T.11, Chipmunk, Hunter F.6 and Javelin FAW.9. Showing-off the Jet Provost was Flt Lt Wingrove of No 2 FTS, who took a delight in flick-rolling at the top of every other loop. Synchronized aerobatics by two Chipmunks of Cambridge UAS came off surprisingly well despite the effects of the wind on smaller aircraft. The USAF contributed fly-pasts by F-100, F-101 and B-66 aircraft, while RAF Signals Command was represented by a trio of Lincolns.

A reminder of the reason for the "at home" came from Sqn Ldr Dickinson and Flt Lt Bell in the Spitfire and Hurricane respectively, and the curtain was brought down by the "Blue Diamonds"—the 92 Sqn Hunters—who had used Waterbeach as a base for their other displays during the afternoon at Gaydon and Biggin Hill.

Most unusual aircraft among the dozen or so in the static park was a Bristol 170 from A&AEE Boscombe Down, while the oldest (*circa* 1934) to be seen in the air was Leopard Moth G-AIYS, which spent the afternoon in company with an Autocrat and Autocar on joy-riding duties.

Space Research in the USA

THE 1961 WILBUR WRIGHT LECTURE, BY DR ABE SILVERSTEIN

The lecturer, Director of Space Flight Programs for NASA, pictured before his delivery of the 1961 Wilbur Wright lecture

"Flight" photograph

ALTHOUGH officially not a part of the Anglo-American Aeronautical Conference, the 49th Wilbur Wright Memorial Lecture of the Royal Aeronautical Society on September 12 attracted many of the delegates attending the joint meeting, and the three presidents of the sponsoring societies—Air Marshal Sir Owen Jones of the RAeS, Dr H. Guyford Stever of the IAS and Air Commodore W. P. Gouin of the CAI—were on the platform as the speaker was introduced. He was Dr Abe Silverstein, Director of Space Flight Programs of the US National Aeronautics and Space Administration, and his subject was *Research in Space Flight Technology*.

After the lecture, a vote of thanks to Dr Silverstein was proposed by Mr B. S. Shenstone, president-elect of the Society, who congratulated the speaker on having presented a wide view of an enormous subject, without mathematics or excessive detail. This was followed by a reception in the Society headquarters at 4 Hamilton Place. Extracts from Dr Silverstein's paper follow:

Propulsion

The burden of providing increased space-flight capability for the future [said Dr Silverstein] falls most heavily on the shoulders of those responsible for the development of the propulsion and associated launch-vehicle systems. The higher the total velocity to be imparted, the greater is the premium on high propulsive performance. In the lunar landing and return mission, in which a total velocity of about 56,000ft/sec is required, a multi-stage, all-solid fuelled rocket vehicle may require as much as 40,000,000lb thrust in the first-stage rocket, and the launch vehicles may weigh 25,000,000lb. In contrast, a three-stage launch vehicle with liquid-propellant first and second stages, and a nuclear heat exchange rocket as a third stage can accomplish the same mission with about 0.1 of this launch thrust and weight. Many analytical investigations have shown the large gains in performance possible from the use of liquid hydrogen either in combination with liquid oxygen or fluorine in a chemical rocket or used as the propulsion fluid in the nuclear rocket. NASA has initiated development of 15,000lb and 200,000lb liquid-hydrogen engines, and, in a co-operative effort with the US Atomic Energy Commission, a heat-transfer nuclear rocket engine. The use of liquid hydrogen as a fuel, with its temperature of 425°F below zero, a density only one-fifteenth that of water and a coefficient of expansion ten times that of most liquids, introduces a host of challenging research problems.

The multifoil technique appears to offer considerable promise for long-term protection of liquid hydrogen in space, but many problems yet remain to be solved. Suggestions have been made for improving the effectiveness of the multifoils by use of surface coatings with a low solar absorptivity. By a combination of properly designed radiation shields, by orientation of the vehicle so that the engine faces the Sun, and by arranging the tanks properly behind the engine, calculations indicate that the hydrogen loss in space due to thermal radiation from the Sun can be reduced to a value as low as 0.003 per cent per day.

Meteoroids The greatest hazard for long-time storage of propellants in space is tank puncture from meteoroids. Information is scarce on the density, composition, velocity, size, and direction of the meteoroids, as well as on the type of damage incurred by the materials that are impacted. Both problems are under study, and microphones have been installed on many of the satellites that have been orbited to measure the frequency and momentum of the impacting meteoroids. A recent summary of the data by C. W. McCraken, including results from Explorer VIII, shows a lower incidence of heavier meteoroids, and consequently a lower hazard to space vehicles, than had previously been predicted from extrapolated data. The experimental programme on meteoroid impact is being extended by flights with the S-55 satellite launched by the Scout vehicle.

Weightless Flight Tank venting, pressurization, and engine re-starting during coasts in orbit or flight through space introduce the question regarding the location of the propellant and propellant vapours during this weightless period of flight. The normal hydrostatic and convective forces are absent, and surface-tension forces prevail. The NASA Lewis Research Center has initiated an interesting approach in which the fluid surface-tension forces are used to position the liquid mass during the weightless period.

The liquid/vapour surface tends to form a sphere. Unfortunately this sphere has no preferred location, and could easily come to rest over the pump inlet. If, however, a structure is erected from the bottom of the tank such that the bubble cannot find enough clear space for a spherical shape to form, it should tend towards the least-surface-area shape imposed by the configuration of the structure.

Pumping Of greatest importance to the development of the liquid-hydrogen engine is the establishment of sound design methods for the pumps. Considerable progress has been made in understanding the phenomena of pumping liquid hydrogen, and the problem can be illustrated by referring to tests (NASA Lewis Research Center) on a research model of a three-stage axial-flow pump. This pump embodies concepts developed for turbojet engines, yet is a relatively new approach to liquid pump design. The three typical stages are the inducer, an intermediate stage, and a high-pressure stage. The inducer is designed particularly to minimize the adverse effects of cavitation with enough pressure-rise to recondense any vapours formed and prepare the fluid for the succeeding stages.

Nuclear Rocket Propulsion

For review a sketch of the nuclear rocket engine system is shown (Fig 1). Hydrogen is pumped from the propellant tank to the jet nozzle, where it is used to cool the walls of the latter. The hydrogen is stored as a liquid at about −422°F at the entrance to the double-walled nozzle. After cooling the walls, the hydrogen cools the reflector of the reactor, which is used to conserve the neutrons required to produce the fission process. The reflector, therefore, helps to reduce the size of the reactor core and the amount of uranium required. The hydrogen then passes through the reactor core where it comes in contact with the uranium fuel. The capture of neutrons by the uranium causes fission of the uranium nucleus, releasing the large fission heat energy. This energy is transferred to the hydrogen flowing through the reactor, and the hot hydrogen gas is then accelerated through the jet nozzle, producing thrust.

Development of the technology of the nuclear rocket is under way in a joint AEC-NASA Rover programme. Reactors will be de-

Fig 1 A simplified schematic diagram of a nuclear rocket engine

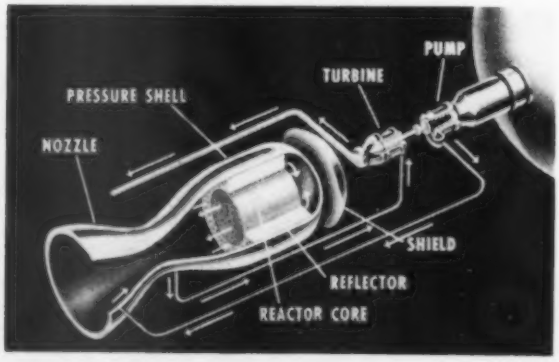
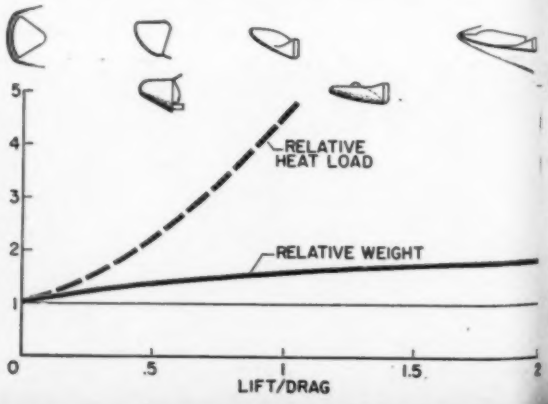


Fig 2 Minimum lift/drag ratio leads to reduced weight and heating



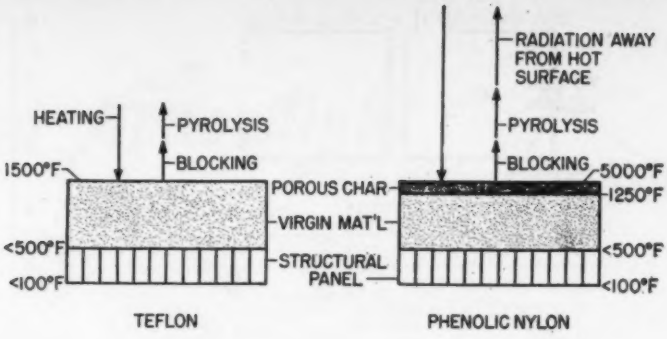


Fig 3 The basic processes of ablation in Teflon and a phenolic nylon. The mechanism is discussed below, where it is pointed out that materials which char are superior to those which do not

veloped to operate at temperatures above 3,500°F, with hydrogen as propellant. Work is also in progress on the development of the other principal components of the system such as the pumps, nozzles, controls and shields.

Aero and Aero-thermodynamics

Spaceflight implies in its language operations outside the Earth's atmosphere. When the NASA organization was chartered in October 1958 with the responsibility for conduct of civilian space activities in the US, and the older NACA was incorporated as a principal component, it was the hope of some of the new management group that the vast complex of NACA facilities for aerodynamic studies might be substantially reduced, to reflect the new mission and achieve economies in plant operation. This hope has not been realized. On the contrary, it has been necessary to construct new and more complex aerodynamic facilities to simulate flight through the atmosphere at higher speeds and higher stagnation temperatures.

In the Mercury programme, to simulate launch and re-entry through the atmosphere from satellite speeds of about 25,000ft/sec, almost every tunnel in the NASA organization and others in the country were used to provide research data on the aero and aero-thermodynamic characteristics of the launch vehicles and spacecraft. Some of the hydrodynamic facilities deactivated in recent years were reopened to study the water-handling characteristics of the Mercury spacecraft and problems of astronaut escape in the water. Continuing to plague the designer are the familiar problems of loads, control, stability, boundary layers and non-steady flows—encountered over a much wider range of speeds and with gas temperatures that lead in some cases to dissociation.

Re-entry Configurations From the standpoint of aerodynamic considerations alone, a wide variety of configurations are available that will provide stable and controllable flight along a parabolic re-entry path. The criteria for the selection of an aerodynamic shape are established by the degree of manœuvrability required and the requirement for minimum weight. The extent of the manœuvrability required is determined by the accuracy of the navigation and guidance system and the requirement for landing at a preselected spot. If touchdown dispersion of the order of about 1,000 miles were acceptable, and if refined guidance techniques were used, manœuvrability would not be required and a simple non-lifting capsule could be used. For this case, the vehicle would have to be guided through a corridor of seven-mile width at entry for it to enter in a single pass or avoid excessive deceleration. To broaden the entry corridor and still achieve acceptable re-entry, aerodynamic forces must be used. If the re-entry is initiated at too high an altitude the aerodynamic force is applied in a direction to decrease the altitude, and the force is applied in the opposite direction if the re-entry altitude is too low. The corridor width for acceptable re-entry varies from seven miles for the ballistic capsule to 40 miles for a spacecraft with a lift/drag ratio of 0.5 and up to about 60 miles with a lift/drag ratio of 3.0.

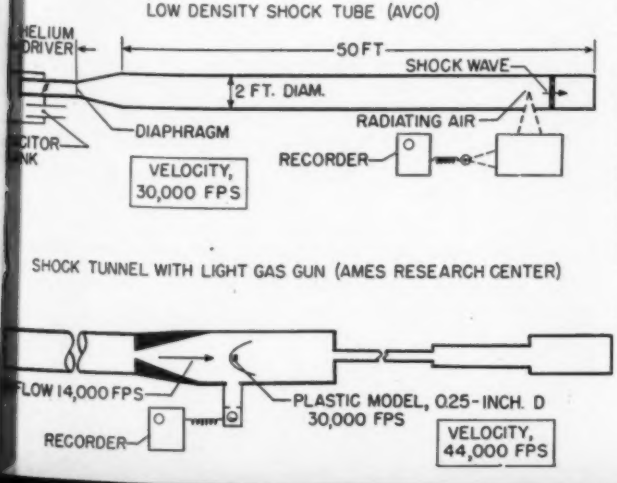


Fig 4 Schematic diagrams of two important radiation-heating experiments. As noted in the text above, the relative velocity in the Ames shock tunnel can reach 44,000ft/sec

The increase in spacecraft weight and heat load with increasing values of L/D ratio emphasizes the desirability of selecting design values of this ratio as low as are acceptable to meet the manœuvrability requirement. Studies indicate that values of L/D in the range of 0.5 to 1.0 meet these requirements for a parabolic re-entry. The configurations for this range of L/D values are generally blunt compact shapes (Fig 2), that provide for good utilization of their internal volume. Extensive tunnel investigations have been conducted on a variety of blunt configurations, and in general it has been found possible to predict their basic force characteristics with reasonable accuracy. Moment characteristics and control force effectiveness are not predicted as reliably from the theory. Large areas of uncertainty remain regarding the dynamic stability and control characteristics of the configurations and control-surface effectiveness.

Re-entry Heating The environment at maximum heating for the parabolic re-entry of a typical re-entry body shape shows the extreme values of gas temperature and enthalpy encountered, and the non-equilibrium state of the plasma behind the shock. The high temperatures in the plasma add to the usual convective heat-transfer by radiation. Theoretical analysis indicates that the increased ionization in the plasma results in higher convective heating rates. Further, the non-equilibrium state of the gases must be considered in determining the heat input.

Thus far theoretical analysis of these phenomena have not received substantial confirmation, and experimental data must be obtained. The principal experimental facilities that have been used in these studies are shock tubes and shock tunnels. Although these facilities provide for simulation of stagnation enthalpy, the corresponding Mach number and Reynolds number are not reproduced. Recently, the NASA Ames Research Center introduced a new technique for measuring heat-transfer rates in free flight in a ballistic range which provides the possibility of correctly simulating Mach number, stagnation enthalpy and Reynolds number for some trajectories of interest. As the stagnation point is heated during the flight of the model, the resulting potential difference between a hot junction and cold junction causes current to flow in the model coil, thus producing a magnetic field around the model. This magnetic field, in turn, induces an e.m.f. on the pick-up coils located along the trajectory of the model, the output of which is then fed to an oscilloscope. Using the resultant temperature/time data and assuming the heat flow is one-dimensional, the heat-transfer rate is computed at the stagnation point.

For manned re-entry at satellite or parabolic velocities with compact blunt bodies, an appreciable amount of laminar flow is anticipated. This may allow the use of laminar heat-transfer data obtained at lower flight speeds for locations other than the stagnation point with some degree of confidence. Heating rates in separate flows, at attachment points, and heating rates in the vicinity of protuberances are not amenable to calculation. Under some conditions heating rates as high as stagnation values have been measured on the afterbody of a typical manned ballistic re-entry capsule. When flaps are added to the configuration, the heating rates in the vicinity of these flaps can approach and even exceed stagnation values.

Although it is difficult to investigate plasma radiation heating characteristics in ground facilities, important progress has recently been made by Kantrowitz and his group at Avco. In an electrical shock tube (Fig 4) a powerful electrical discharge sends the shock-wave down the tube at speeds up to 30,000ft/sec. The conditions in plasma just behind the shock correspond to the gas cap in flight, and appropriate radiation intensity measurements can be made. It is hoped ultimately to achieve shock speeds as high as 40,000ft/sec by this technique. The gun-fired model technique has been successfully developed and explored by the NASA Ames Research Center. To achieve the parabolic re-entry speed of 36,000 ft/sec and higher, the gun is combined with a shock tunnel, and relative speeds of

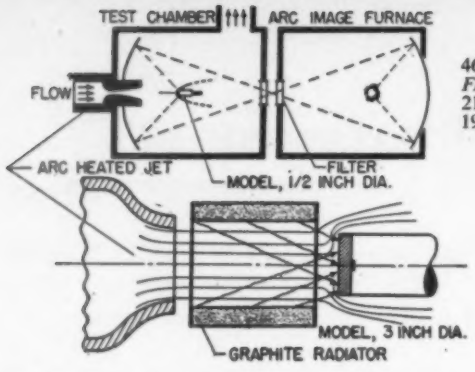


Fig 5 Re-entry heating research at both Ames and Langley demands facilities of the type illustrated above

Space Research in the USA . . .

44,000ft/sec may be obtained. A limitation of the technique is the small size of the test object (0.25in diameter).

Materials used for heat protection of the spacecraft re-entering at parabolic velocity must be designed to cope with the high heating rates of steep re-entry and the long-duration heating of shallow re-entry. The only practicable scheme seems to be the use of an ablation material tailored to these requirements. The concept of simple ablation is illustrated best by a material like plastic, Teflon, which sublimes at about 1,500°F (Fig 3). For this material the released gas thickens the boundary layer, and thus blocks the transfer of heat from the hot gas cap. In addition, the various reactions involved in the sublimation process, collectively called pyrolysis, also absorb heat.

A more complex class of ablating materials which are composed of phenolic resins and plastics may be of greater interest for re-entry at parabolic velocity. The pyrolysis temperature of such material is low, comparable to that of Teflon, but the presence of the phenolic resin drastically changes the mechanism by which the material ablates. Pyrolysis in this case produces a tough, porous, black char which thickens as the entry proceeds. This char has surface temperatures in the 5,000 to 6,000°F range, high enough to radiate as much as half of the heat away from the surface. Ablation of gases continues through the pores of the char, so that the advantage of the blockage is retained. Thus, this class of material is definitely superior to those which do not char. Naturally, the problem involved here is to improve the char layer. This can be done by the development of advanced materials designed for faster char growth and reduced pyrolysis temperature at the base of the char. This will reduce the amount of virgin material carried along for insulation, since this is the major part of the heat protection weight. Improvements in the strength and the integrity of the char are also to be desired. Recently, important answers to the question how these materials are affected by the combined radiative and convective heating have come from research in facilities at the NASA Ames and Langley Research Centers (Fig 5).

Structures

Despite the need for the utmost design refinements in space structures and for the most dexterous matching of materials characteristic to structural arrangement, a proper review of the total effort on these problems might find it lacking. The explanation may lie in a statement by Rhode in 1958, " . . . while it has taken man some 50 years to reach flight speeds of 1,000ft/sec, he is now trying suddenly to bridge the gap between these speeds and values 25 times as large." In 1961 the number is more appropriately recorded as 36 times as large.

Structures erected in space provide the opportunity for extreme ingenuity in design. An elementary structure of this type is the Echo sphere, orbited over a year ago and still visible in the night sky. Fabricated from 0.0005in Mylar, the 100ft sphere weighed only 123lb. Recent communications from the satellite were of almost the same quality as when it was erected. This satellite may have greater significance as a pioneer in erectable structures than as a communications medium. The programme is to be continued with both objectives in mind. A 135ft sphere is to be orbited, the skin of which is a sandwich having outer layers of 0.00020in aluminium foil and a core of 0.00035in Mylar. The skin stiffness is estimated to be 20 times that of the Echo sphere. It is believed that it will not collapse in space, even if punctured with meteoroids. The aluminium outer foil should protect the plastic from ultra-violet radiation.

Superimposed on the more conventional load sources in spacecraft is aerodynamic heating, which produces thermal stresses and reduces the strength and stiffness of the structure at elevated temperatures, thereby increasing its susceptibility to dynamic problems. These involved interactions among aerodynamics, elasticity,

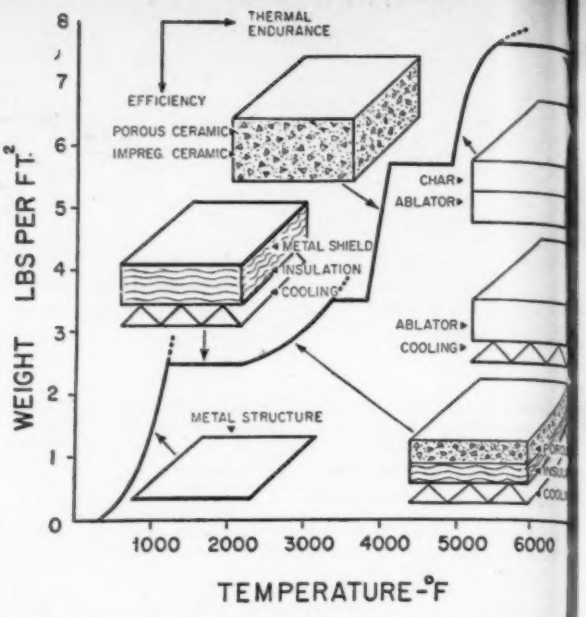


Fig 6 Some of the goals towards which research into the thermal protection of surfaces for re-entry vehicles is being directed

inertia and heat have been described by Garrick; and Collar's aeroelastic triangle of 15 years ago now includes only a part of the total, and his title—*The Expanding Domain of Aeroelasticity*—might be increased to *The Expanding Domain of Thermoaeroelasticity*.

A basic difficulty arises from the wide range of heating rates and total heat inputs that can occur as re-entry is made along different paths in the corridor. A high heating rate and a low total heat input, which occurs in a sharp re-entry along the bottom of the corridor, might require the use of a low-temperature ablating structure to achieve minimum weight. A high total heat input with a low heat flux rate, for a low-g re-entry along the top of the corridor, may be more efficiently accommodated with an alternate structure. Currently the weights of all the thermally protected surfaces (Fig 6) are high.

Dynamic loading and structural response of the launch vehicle provides another fruitful area for research. Several failures of United States satellites can be traced to inadequate analysis of the dynamic stresses occurring during launch. As the size of launch vehicle is increased to provide thrust for advanced missions, problems from fuel sloshing, interactions between the elastic vehicle frame and the controls, and from the wind gradients and wind shears will become more difficult. Recent studies of fuel sloshing show excellent agreement between theoretical and experimental values for the sloshing frequency and for the force exerted by the sloshing liquid. For a spherical tank the oscillating force is at a maximum at the first fundamental frequency of the tank when it is half full. The frequency of the first mode decreases with increase in tank radius, which leads to the dangerous possibility of resonance with the elastic frequency of the vehicle structure and saturation of the controls. Baffles are obviously required, and the solution of this problem for varying levels of the tank fluid is under active investigation.

Much of the available statistical data on wind gradients have been obtained using sounding balloons tracked by a theodolite. More accurate measurements using photographs from three stations of smoke trails show that the possibility exists for grossly miscalculating the stresses due to wind gradients. Since the maximum wind gradients and maximum aerodynamic forces occur at about the same time in the flight, angle-of-attack changes due to the wind gradient lead to high dynamic loads. Geissler describes methods for reducing vehicle structure loading and control requirements by turning the vehicle into the wind to reduce the angle of attack and resulting dynamic stresses. The addition of stabilizing tail surfaces to furnish essentially neutral vehicle stability for the critical flight conditions alleviates the stress and control problems, but for large vehicles is expensive in weight and adds the design problems of the large surfaces and their vehicle attachments.

In the author's opinion, elimination of rocket-engine swivelling on large space vehicles would provide one of the greatest potential opportunities for improving reliability. The basic space vehicle is statically and dynamically unstable, with the c.p. high above the c.g., while the engines that provide the controlled stability are much closer to and below the c.g. The possibility exists for using controlled canard surfaces located near the c.p. of the aerodynamic forces for flight through the atmosphere, and jets at the nose of the vehicle for control during the initial launch period and in space flight.

Missiles and Spaceflight

UNMANNED MERCURY ORBIT ACHIEVED

An unmanned Mercury spacecraft was recovered from the Atlantic near Bermuda on September 13 after successfully completing one Earth orbit and re-entry. The craft was launched by Atlas booster from Cape Canaveral and contained a "crewman simulator" as described in our issue of August 31. Official designation of the firing was Mercury-Atlas 4 (MA-4).

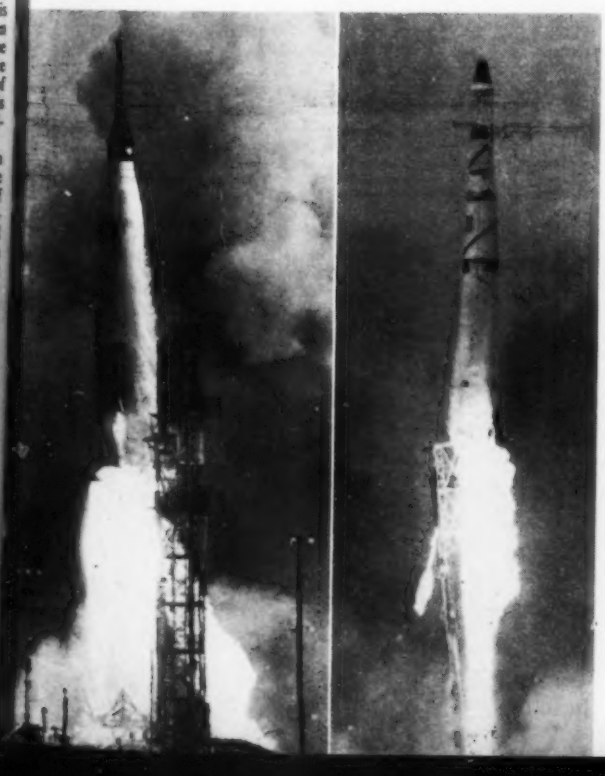
The flight lasted 110min and recovery was effected by the destroyer *Decatur* 80min later. Obital height attained was 99–144 miles. The National Aeronautics and Space Administration reported that the craft performed well, and that all twelve ground stations were in touch with it during the orbit. The flight was said to have achieved the following objectives:

1. Proved that the Mercury spacecraft can withstand the 2,000°F re-entry heat for a period eight times longer than in the suborbital flights of Shepard and Grissom;
2. Demonstrated the ability of the 360,000lb-thrust Atlas to release the spacecraft at the precise speed, altitude and flight-path angle for orbital flight;
3. Proved the integrity of the spacecraft and its interior communications, power and life-support systems for 110min;
4. Exercised for the first time the worldwide Mercury tracking and communications network; and
5. Checked the ability of retro-rockets to return the craft from orbit.

RUSSIAN ROCKETS

The Soviet Union initiated a new series of tests with large rocket vehicles on September 13, when "a more powerful and improved multi-stage carrier rocket" was fired over "more than 12,000km" (7,450 miles) to the designated impact point in the central Pacific. According to *Tass*, the operation of all stages "fully conformed with the set programme," and the re-entry vehicle impacted "less than one kilometre" (1,090yd) from the target.

An article devoted to the advance of Soviet rocketry and the combat training of rocket troops, written by the Deputy Minister of Defence and Supreme Commander of Soviet Missile Forces, Marshal Kiril Moskalenko, appeared the previous day in *Krasnaya Zvezda*. In this, Moskalenko said that the Soviet ICBMs were capable of delivering nuclear warheads to any point of the world, regardless of the time of year, time of day or meteorological conditions. The Soviet Union was capable of dealing powerful blows to a large number of objectives simultaneously, while remaining invulnerable to present-day means of counter-action. The more-powerful and improved versions of Russian multi-stage rockets, he disclosed, had been prepared for testing and would be launched into the Central Pacific area between September 13 and October 15.



VOSTOK 2 DETAILS

An article in *Pravda* on September 8, describing the *Vostok 2* spacecraft in which Maj Herman Titov made his 17-orbit flight on August 6, disclosed that the craft differed from Maj Gagarin's *Vostok 1* in having a new type of air regenerating system. Also quoted were revised orbital data for the second Vostok—apogee, 244km (152 miles); perigee, 183km (114 miles); inclination 64° 56′ and initial period, 88.46min. The cabin shell had three portholes and two quick-opening hatches, and the portholes were glazed with heat resisting glass and fitted with shutters. Radio receivers and transmitters, together with food and other items, were contained in the pilot's seat.

GERMAN SOUNDING ROCKETS FIRED

On September 16 a series of tests using small sounding rockets was made by members of the West German Rocket Society near Cuxhaven. Three test firings of a two-stage meteorological rocket were made, one of which was reported as successful, achieving a peak altitude of approximately 40 miles. In another firing, using a single-stage rocket, a goldfish and a salamander were included in the payload; a height of about 33,000ft was attained and the payload was recovered from the North Sea.

SATURN UPPER-STAGE FOR NORTH AMERICAN

A $140m contract to develop an upper stage (S-2) for the advanced Saturn launch vehicle is being negotiated between the US National Aeronautics and Space Administration and the Space and Information Systems Division of North American Aviation Inc.

The new stage will employ four liquid oxygen/hydrogen engines delivering a total thrust of 800,000lb, which are being built by the Rocketdyne Division of North American under a separate contract. It will be used as a second stage for the C-3 version of Saturn which, with a first stage powered by two 1.5 million pound thrust engines, will be capable of placing a 40-ton spacecraft in a 300-mile Earth orbit. For missions requiring escape velocity, a third stage (S-4) with six 15,000lb thrust liquid oxygen/hydrogen engines would be added to carry spacecraft weighing up to 15 tons.

Tentative plans call for the use of Saturn C-3 to place Apollo spacecraft carrying three men in orbit around the Moon. Manned Apollo lunar landings will probably await development of a Nova-class booster requiring a cluster of F-2 engines in the first stage.

MORE DISCOVERERS

The 300lb instrument capsule of the Discoverer 30 satellite was successfully recovered by the USAF in mid-air near Hawaii on September 14 after launch from Vandenberg Air Force Base, California, two days previously. Orbital elements for the 2,100lb satellite prior to ejection of the capsule include: apogee, 345 miles; perigee, 154 miles; period, 92.4min.

On September 17 Discoverer 31 was placed into near-polar orbit from Vandenberg, and it was stated that an attempt to recover the instrument capsule would be made within a few days. A Thor-Agena B launch vehicle was used in each of the two firings.

FRENCH/AMERICAN FIRING

A four-stage sounding rocket carrying a 145lb payload to a height of 228 miles was launched in a joint American-French experiment from Wallops Island on September 13. NASA scientists and a French group led by Prof J. A. Blamont co-operated in the firing, in which two clouds of sodium vapour were ejected and photographed to provide information on atmospheric winds, temperatures and densities.

BLUE STEEL BLUES

Officially A. V. Roe & Co Ltd are not in a position to comment upon unofficial reports asserting that the big stand-off missile produced by their Weapons Research Division is in serious trouble, and will enter service with RAF Bomber Command far behind the original schedule. All such matters are, of course, strictly confidential. On the other hand, the Air Ministry have often replied to such charges, and they deny the contention—published last week in a London newspaper—that Blue Steel is so far behind that it will enter service almost at the same time as Skybolt, in 1965, and that it will not be fitted to the Vulcan at all. According to the Air Ministry, there has been no change in the decision to fit Blue Steel to both the Victor B.2 and Vulcan B.2 and—as the Air Minister announced in the Air Estimates debate on March 8—the missile will become operational with Bomber Command next year.

Left, Atlas-boosted launch of unmanned Mercury spacecraft from Cape Canaveral on September 13. Right, Vandenberg lift-off of Thor-Agena B carrying Discoverer 30 on September 12 (see respective news items)

Missiles and Spaceflight . . .

ANGLO-AMERICAN SPACE TOPICS

Astronomical Cost In the discussion following his paper *Upper Atmosphere Experiments with Particular Reference to Black Knight and Skylark* at the Anglo-American Aeronautical Conference in London last week, Prof Sir Harrie Massey, Chairman of the British National Committee on Space Research, declared that the expense of exploring outer space could not be justified on purely scientific grounds. Scientists would certainly take advantage of flights to the Moon, Mars and Venus if such flights were made but, on "United Kingdom financial standards," pure science alone could not foot the bill.

Dr W. F. Hilton of Hawker Siddeley Aviation suggested that it would be more valuable to place a telescope with a trained observer on the Moon than to mount a telescope in an astronomical satellite in Earth orbit. Sir Harrie replied that very few astronomers made discoveries by actually looking through a telescope—they studied photographic and other records, and they might well need a very large computer on the Moon in addition to a telescope there. If the facilities on the Moon were good, well, all right, but we should not exaggerate the importance of having men on the spot. Sir Harrie, for one, would not wish his income tax to go towards a lunar astronomical station merely for the sake of science.

Mercury-Apollo Link The gap between the US Project Mercury man-in-Earth-orbit programme and the Apollo manned lunar exploration programme will be bridged by extended Earth orbits by Apollo-type spacecraft. This was stated in an interview at the Conference by Dr Abe Silverstein, Director of Space Flight Programs, National Aeronautics and Space Administration.

There was also the prospect, Dr Silverstein said, that the Mercury programme itself would be extended. Initially designed for an operating life of 28hr, the Mercury spacecraft could be used for 24hr orbital flights. It could, but probably would not, be used for orbital flights of several days' duration.

The most important single development needed in the overall field of space exploration, Dr Silverstein opined, was to increase the reliability of components.

Tiros Data-Handling As briefly reported last week, details of the results achieved by the Tiros series of US meteorological satellites were given by Dr W. G. Stroud of Goddard Space Flight Center in his Conference paper *Meteorological Measurements from the Tiros Satellites*. Included in Dr Stroud's paper were the comparative details given in the table (right), and the following account of the complex processing of Tiros data.

On the average, seven orbits of data (about 450 pictures and seven radiation tapes) are obtained each 24 hours. The data received from the satellite are recorded in several formats at the ground stations. The telemetry data which handle all the "housekeeping" parameters, such as voltages, currents, positions and so on, which measure the performance of the instrumentation, are recorded on strip charts in analogue form for immediate analysis. The geophysical data are recorded in two formats, one magnetic tape and the other as pictures. Both the picture and radiation data are recorded on high-fidelity magnetic tape. These tapes are shipped to Goddard Space Flight Center for processing and archival purposes.

For immediate operational use at the station, the picture data are recorded on 35mm film by means of a photo-kinescope. The film strip is rapidly processed at the station and teams of meteorologists, by projecting the pictures on rough latitude-longitude grids, which are machine-computed right at the stations, are able to prepare nephanalyses of the areas photographed by the satellite. These nephanalyses are prepared in a format for facsimile transmission so that within three to six hours after a satellite pass the facsimile nephanalyses are transmitted to the National Weather Center at Suitland, Maryland, and then over the national weather communication circuits to the field users of meteorological data. Within these time intervals these nephanalyses of limited areas of the Earth appear at all major Weather Bureau stations throughout the country, on ships at sea, and at many of the US military installations around the world.

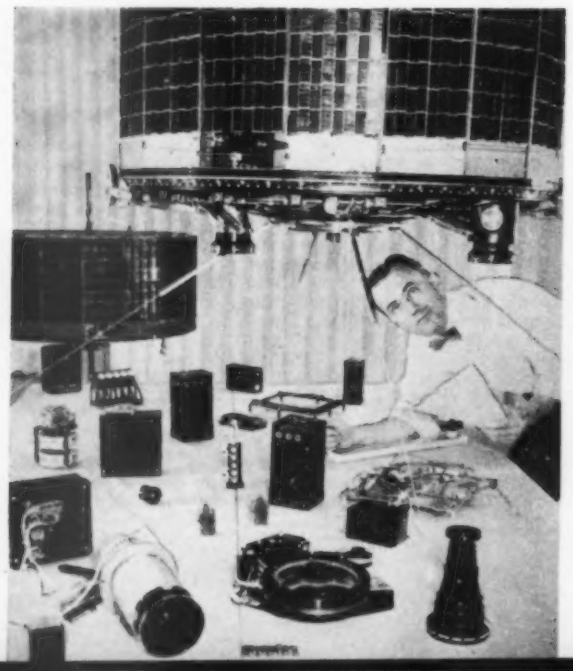
TIROS RESULTS

	Tiros 1	Tiros 2	Tiros 3
Launched	April 1, 1960	Nov 23, 1960	July 12, 1961
Days of data transmission	78*	Still transmitting	Still transmitting
Approx no of pictures transmitted	23,000	35,650	12,000
Orbits of radiation data obtained	†	1,601‡	367
Major failures	(1) Narrow-angle camera out between orbits 22 and 572 (2) Relay failure destroyed battery power system	(1) Wide-angle lens coated by rocket exhaust, pictures poor (2) Decay of interference filters on two scan radiometers after several months	(1) One camera shutter hung up (2) Decay of interference filters on two scan channels of radiometer

* Beacons still transmit when in sunlight. † The radiation experiments were not included in Tiros 1. ‡ Five-channel radiometer motor stopped April 27, 1961. Balance of sub-system still operating.

The original film containing the pictures is returned by mail to the Naval Photographic Center in Washington, where it is processed, and positive and negative copies are made and distributed to all research users of the data. After gridding, the master film is sent to National Weather Records Center in Asheville, North Carolina, from which centre 100ft strip copies may now be purchased.

The radiation tapes are mailed to Goddard, where they are processed in a two-step procedure; first, to a digital magnetic tape format which contains the raw radiation information as a function of time; then, by mating this tape with a similar tape containing



Left, Tiros 3 (upper foreground) and components for duplicate back-up Tiros payload (background). Right, Tiros 3 photograph of Florida peninsula, showing line of thunderstorms across Gulf of Mexico. (Both illustrations from paper by Stroud.)

As reported last week, and commented upon below, No 36 GW Regt, Royal Artillery, is on its way to reinforce BAOR anti-aircraft defence. Here Maj-Gen E. J. H. Bates visits the regiment before departure

The first test firing of a complete Nike Zeus anti-missile missile, with two "hot" stages and airborne guidance system, took place from Pt Mugu, California, on September 9. Details are given on this page

the orbital elements and with calibration and attitude data, to a final meteorological radiation tape (again in a binary format) which is the basic method of publication of the data. From this tape, by means of appropriate computer programmes and print-out equipment, tabulations, grid prints and contour maps on various scales may be obtained. Fifty selected orbits of Tiros 2 radiation data in the form of 1 in 6 million and 1 in 30 million grid-prints are now in publication as a NASA Technical Report.

How Low the Orbit? Scientific satellites in low-altitude orbits (less than 200km) were suggested by Dr W. F. Hilton during a discussion period at the Anglo-American Conference. Although normally considered as the realm of sounding rockets, he said, this region could be used by satellites, provided they were specially designed. Using low frontal area, and low-drag aerodynamics in general, satellites could be orbited for long periods as low as 80km.

Dr W. G. Stroud of NASA asked what these satellites would measure and what would be the gain from their use. Flow problems were such that one would not be able to measure atmospheric parameters. If the object was to look out into space or down at the Earth, one might as well choose higher orbits.

Absent Author, Wrong Title The paper written by Dr George E. Mueller of Space Technology Laboratories for presentation at the Conference was *Advancement in Spacecraft Technology*, and not (as printed in the conference programme and pre-prints by the Royal Aeronautical Society) *Communications Satellites*. In the absence of Dr Mueller the paper was read by STL's director of European operations, Mr R. B. Rypinski. It contained a review of spacecraft development, from the "first generation" in which (because of the size restriction caused by the available boosters) miniaturization was developed and the optimization process became crucial, through the second generation of more-sophisticated craft, to the third generation with which manned spaceflight was being accomplished.

THUNDERBIRDS IN GERMANY

Late this month 36 Guided Weapon Regiment, Royal Artillery, is bound for Germany—as reported in *Flight* for August 31—in answer to a call for increased anti-aircraft protection for BAOR. On September 12 the Director of Royal Artillery, Major-General E. J. H. Bates, visited the regiment at their base at Shoeburyness (see picture).

According to unofficial reports, the War Office have "not ordered enough Thunderbirds to equip one regiment on an active basis." According to the *Daily Express*, deliveries from English Electric Aviation's plant at Stevenage have for some time all been diverted from No 37 Regiment (which performed at Farnborough) to No 36; and even this is said to leave No 36 with only 16 missiles instead of the active service quota of 48, and eight launchers instead of 24.

The National Aeronautics and Space Administration's Ranger 1 spacecraft, launched on August 23, completed 111 orbits of the Earth before re-entering the atmosphere and burning up on August 29. NASA reported that "the flight demonstrated that the spacecraft orientation, communications and electronic systems worked well."

The US Government's Michoud ordnance plant near New Orleans is to be used by the National Aeronautics and Space Administration for the fabrication of large launch-vehicle stages. The plant is adjacent to the Michoud Canal, which is large enough for ocean-going barges, and includes a 5,500ft runway capable of being lengthened to 7,000ft to accommodate large cargo aircraft.

On August 30 Republic Aviation reported a $193,900 USAF contract for the construction of a compact, battery-powered pinch plasma engine. Since 1957 Republic have been leaders in the development of such propulsion. The new engine will be completely self-contained, and should meet all practical requirements for actual use in spacecraft. The significance of the contract is given as the "progression of the plasma-engine principle for propulsion from the research to possible developmental status."

The first full-scale firing of a Nike Zeus down the Pacific Missile Range took place at Point Mugu on September 9. Only two of the three solid-propellant stages were fired. The 48ft weapon "roared westward over the Pacific and disappeared over the horizon in seconds," but an internal malfunction caused it to blow up approximately 20sec after launching. It was unofficially said that the missile was due to be destroyed by radio command several seconds later, at an altitude of 100,000ft. This was the first test of the missile, guidance and related systems and it will be followed by further tests both from Point Mugu and Kwajalein.

A Boeing scientist, Dr M. J. Kofoid, has succeeded in obtaining laboratory confirmation of the plasma-damping theory advanced in 1945 by Prof L. D. Landau. This verification is expected to be of considerable importance to controlled thermonuclear power.

Astropower, Inc, a subsidiary of Douglas Aircraft, has been awarded a $46,000 contract by the USAF Flight Test Center (Edwards AFB) for the design and manufacture of water-cooled propellant injectors for experimental rocket engines. The latter will be in the 40,000lb class, and deliveries from Astropower's Costa Mesa plant will begin in three months.

NASA test pilot Joe Walker achieved a speed provisionally calculated at 3,645 m.p.h. in an X-15 on September 12, 42 m.p.h. faster than the previous highest. The flight-plan called for 3,700 m.p.h., but this was not reached owing to failing fuel pressure. On September 6 Goodyear's Aviation Products Division announced a contract to supply new "wire-brush" skids to replace the smooth skids currently used on the X-15 aircraft. The wire skids will allow the aircraft to land on standard asphalt or concrete runways; the smooth skids can be used only on the dry lake bed at Edwards.

Earlier this month a number of ICBMs were launched down the Atlantic Missile Range. On September 6 a Titan flew 6,100 miles, and its re-entry vehicle impacted in the designated area, after discharging a data capsule by parachute to provide information on the effects of radiation on fruit flies, skin-tissue and other elementary organisms. On the night of September 7 another Titan flew 5,000 miles from Cape Canaveral, principally to check the new AC Spark Plug inertial guidance for later Titan versions. On September 9 an Atlas—probably an E model—impacted only about 200 miles out, as the consequence of a premature shutdown.

FLIGHT SYSTEM SURVEY

A Comet for BLEU

FOLLOWING a long career of development flying in support of the Comet 4 programme, the Comet 3B prototype has now been removed from the civil register and is flying with the RAF serial number XP915 for the Blind Landing Experimental Unit at RAE Bedford. This will give BLEU a representative jet airliner in which trials of civil automatic landing equipment can be flown.

Hot Stuff for the Sixty-Series

THE communications element of the new Marconi Sixty Series radio, the AD.160, was recently installed in a Hastings and flown out to Bahrain for tropical trials. Ranges in excess of 130 miles were constantly obtained from a height of 10,000ft and the set worked satisfactorily throughout the trials. Sixty Series equipment is, of course, specified for the BOAC VC10s and for BEA Tridents.

More Simulation at the College

OPERATIONAL acceptance trials of the second flight-procedure trainer made for the College of Air Training by General Precision Systems Ltd have been completed. The trainer, one example of which has already completed some months' work at Hamble, is essentially a generalized flight deck with typically modern instrumentation and controls but not resembling a specific type of aircraft. The associated analogue computer can rapidly be altered to represent a two- or four-turboprop powerplant or two or four turbojets. The handling characteristics can also be adjusted accordingly. Students can complete all checks and manœuvres, a wide variety of faults can be introduced and the progress of the flight can be traced on a plotting table.

Data Processing for Paris ATCC

AN experimental flight-plan processing system based on an IBM 650 RAMAC computer is being installed at the ATCC at Paris Orly this month. The computer will store routes and aircraft characteristics in its memory and will automatically produce flight progress strips giving ETAs over fixes. Information can be up-dated and the estimates adjusted accordingly; and the computer will calculate and notify by printed message any conflicts which are likely to occur. The corrective action taken by the controller is then checked to ensure that no additional conflicts have been caused. The tracks of aircraft flying off the established routes can be fed into the computer in the form of a series of geographical co-ordinates. The system should be in operation before the end of this year, and co-operation with the military defence system may follow.

A New Procedure Trainer

THE first production model of the series of flight-procedure trainers designed by Electronic Control Engineering of Burgess Hill, Sussex, has been completed. One of the ECE/60 basic series of trainers has already been sold to the Finnish Air Force. Equally suitable for *ab initio* training, instrument rating checks or approach-procedure training, the new trainer incorporates the latest electronic and electro-mechanical techniques. A cockpit representative of modern high-speed jet aircraft is fitted with equipment to the customer's choice and the true-analogue computer can be calibrated to simulate the performance of a wide variety of aircraft. A radio-aids console allows automatic simulation of ADF, VOR and ILS; and a 25in-square plotting table accurately records the theoretical flight-path of the aircraft. The trainer is inexpensive, and its unit construction makes it easy to service. It can be installed in a matter of hours.

One version of the moving-map display being engineered by Ferranti from a design originally developed by RAE. The map is back-projected from 35mm film, movement being controlled in early trials by G.E.C. Dexan airborne digital navigator

Ryan in Europe

BOTH the Ryan Electronics and Ryan Aerospace Divisions of Ryan Aeronautical Co are represented at the new Paris office at 102 Champs Elysées under the direction of Lt Col A. C. Jourdin. The company hopes to increase its European sales of Doppler for aircraft and helicopters, and of the Ryan Firebee target drone.

FAA Doppler Trials

THE Federal Aviation Agency has approved in principle the use of Doppler radar with other navaids during airline flights over the North Atlantic. Trials were carried out during six weeks in May and June on one of the 12 Boeing 707s which TWA has fitted with Doppler. Final approval will depend on completion of the necessary pilot training programme and on refinement of procedures. The FAA states that the main advantage of Doppler is that it provides a constant check on position between fixes obtained with existing navaids such as Loran, VOR and weather radar. The TWA computers indicate distance left or right of track and distance to go to a given check-point.

Tactair's Latest Autopilot

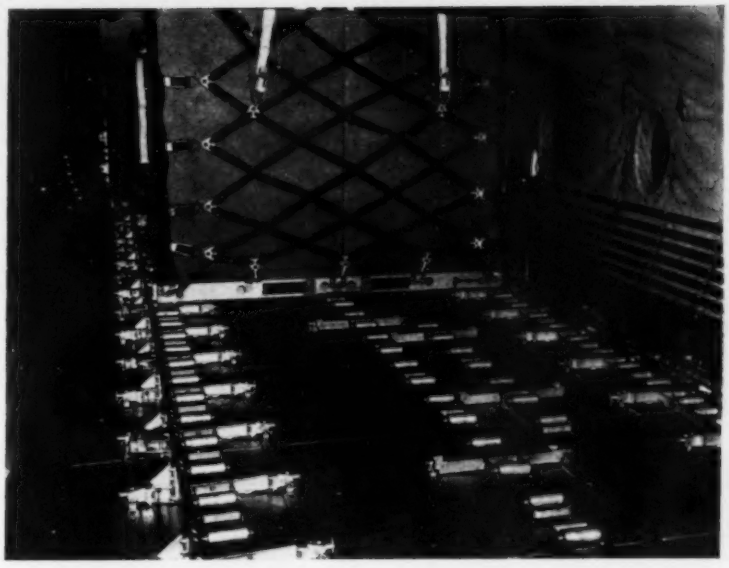
A SIMPLIFIED version of the original T-3 three-axes pneumatic autopilot which has been produced for some years by Tactair Inc has now been developed for single-engined aircraft. Costing only $495 (about £177) in the US, the system has two pneumatic bellows operated by 8in suction derived either from the vacuum system of the aircraft or from a venturi. The bellows can exert a force of up to 125lb, although no more than half this is normally required. Ailerons alone are controlled, longitudinal attitude being trimmed beforehand. The sensing element is a gyro with a single inclined gimbal which will sense both lateral and directional displacements of the aircraft. The gyro is tumble-proof and is driven by the standard four-pound instrument suction. Round the gimbal unit is the metering device which can be biased by control knobs to trim the aircraft in straight flight or to demand a turn up to Rate 1.

The gyro, on/off knob and turn and trim knobs are all mounted in a single case measuring 3¾in wide and 2¼in deep. No warm-up time is needed. Actuator forces are proportional to aircraft displacement from datum and the system can be manually overridden and causes no interference when not engaged. The new autopilot is designated T-101 and additional elements, including course selecter, pitch control and height-hold are being prepared.

The three-axes T-3 was cleared for aircraft ranging from the Beech 18 to the Cessna 175.

The Honeywell automatic system analyser being used to check out a USAF F-104. The system is available from Honeywell Controls Ltd in Britain and has been ordered for the CF-104 and F-104G

An 88in-wide pallet, with cargo secured by nylon webbing, being unloaded from a Riddle Argosy. The pallets are secured in flight by automatic rail restraint locks, common to all USAF freighters



CARGO LOADING: AN AMERICAN DEMONSTRATION

AS originally delivered by Armstrong Whitworth to Riddle Airlines, of Miami, the AW.650 Argosy was fitted with elements of the British firm's Rolamat system. Now the rollers have been integrated with the USAF standard 463L system, adapted to the 88in by 54in or 108in pallet. A demonstration of the system is described on this page.

MAJOR components of a cargo handling system designed to multiply and expedite the airlift capability of the United States were displayed recently by the US Air Force and the American Machine & Foundry Company. The demonstration, at Stewart Air Force Base, NY, was of equipment developed under a contract with the USAF Aeronautical Systems Division, Wright-Patterson AFB. A 40,000lb-capacity self-propelled cargo loader and a universal cargo-handling system, which together constitute the heart of the Air Force 463L materiel* handling support system, were shown to Air Force and airline representatives.

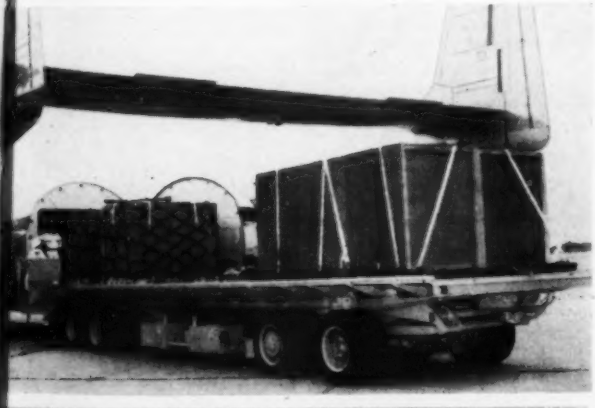
Less than a year ago the Air Force awarded AMF two major contracts under the 463L programme. One, for the universal cargo-handling system, concerned pallets, conveyors and rails. The equipment developed is applicable to all three existing USAF cargo carriers—C-124, C-130, C-133—and to a British commercial cargo aircraft, the Argosy, operated by Riddle under USAF Logair contracts. The loader contract is for three vehicles each capable of lifting 40,000lb to a wide range of aircraft freight-deck heights and to receive loads from trucks, rail vehicles and warehouses. The loader incorporates a high-lift loading platform which can raise its load to any height between 40in and 13ft. The platform can be raised, lowered, pitched or rolled to meet almost any conceivable loading requirement. Two remotely controlled pallet-conveyance mechanisms are used separately or in co-ordination to move cargo from the platform into the aircraft compartment. During the demonstration the lift platform was variously adjusted to handle simple cargo, general "skidded" cargo and fully loaded vehicles, all three in an overall time of under 15min. The demonstration also showed how the loader could be precisely adjusted to the usual settling and minor pitching and rolling of an aircraft taking heavy freight on board.

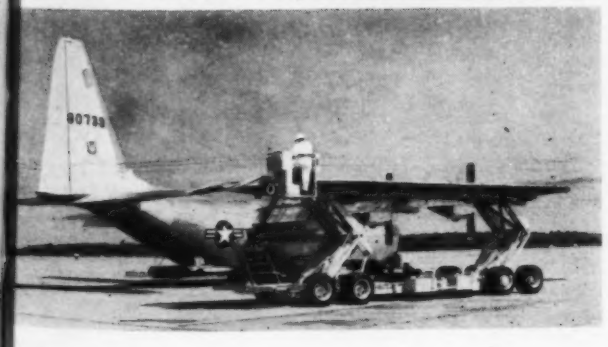
The handling system is designed to accept standard US pallets of the 88in × 108in (10,000lb capacity) and 88in × 54in (5,000lb) sizes (different sizes are standard in the UK). The ten-foot rail modules are sturdy enough to retain the pallets under crash conditions, yet are light enough to be handled by two men for installation. During the demonstration the Argosy was completely fitted with a full set of roller rails in less than an hour by a four-man crew who had never worked on this type of aircraft before.

The pallets are secured against movement in the freight hold by a system of restraint locks on the rails. The restraints may be released from a remote control point, either simultaneously for air drops or sequentially for ground unloading. Controlled movement of the pallet automatically releases the forward restraints, which remain open for subsequent aircraft loading. For heavy loads, this restraint system is lighter than orthodox chain tie-down devices. In addition, it provides uniform restraint under forward accelerations by eliminating the variations in tie-down tension obtained in hand-rigging.

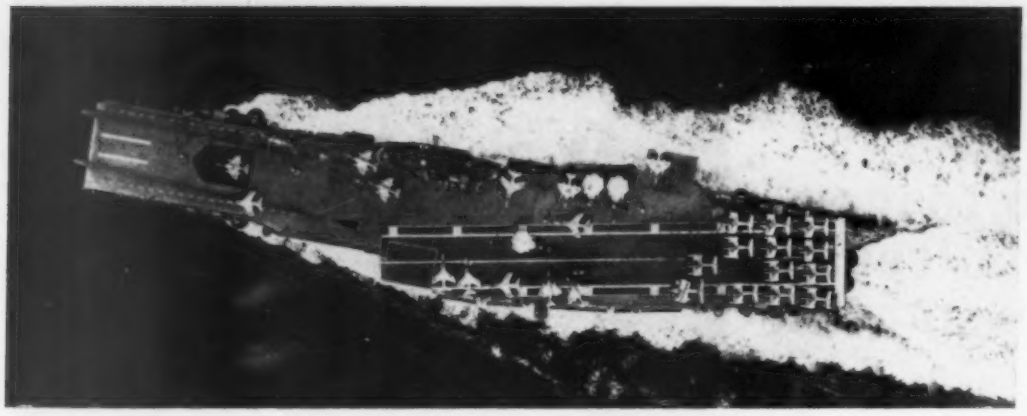
AMF pallets are of strong, light-weight design and should be amenable to long service with little replacement or repair. Of aluminium honeycomb construction, they have equally spaced slots at their perimeters to allow exact positioning in the rail and restraint system according to loading itinerary and weight-balance requirements. In the smaller-sized pallets there are receptacles for fork-lift tines. High-strength nylon nets secured to tie-down rings fixed to the pallets assure adequate restraint of the cargo against sudden shifts in direction or velocity.

* *This US word, which "Flight" frequently has to use, means stores and equipment of all kinds—everything in an inventory.*





Home base for the seven Argosies is Tinker AFB (Oklahoma City Air Materiel Area), but Stewart—a regular port of call—was chosen for the demonstration. The loading vehicle is seen drawn up to an Argosy, and—with C-130B behind—in the elevated position



ABOARD THE USS "INTREPID"

By an American Correspondent

SOME of the operating techniques of US Navy airpower as employed in the Mediterranean were demonstrated to a group of aviation writers recently when they were invited to take a one-day cruise off New York harbour aboard the USS *Intrepid*. The big carrier had been on a six and a half months' cruise in the Mediterranean with the US Sixth Fleet, and had just completed an interim overhaul at the Norfolk Naval Shipyard, Portsmouth, Va. She has now returned to the Mediterranean to rejoin the Sixth Fleet.

Her keel was laid at Newport News, Va, six days before the Japanese attack on Pearl Harbour. She is 893ft long, 186ft at the beam and displaces 43,500 tons. Her steam turbines can generate 150,000 horsepower to drive four screw propellers, each 18ft in diameter, and give the ship a speed of 30kt. Commissioned in April of 1943, *Intrepid* took part in many Pacific battles, and was decommissioned at the end of World War 2. Recommissioned in 1952, and equipped with steam catapults of British design, she again went to sea as an attack carrier. Another conversion and overhaul, in 1956, included an enclosed hurricane bow and an angled deck. Since 1954, the carrier has travelled 350,000 miles.

Usually 68 aircraft are on board, and the crew numbers 3,000 men. During her most recent tour of duty in the Mediterranean, *Intrepid* lost neither planes nor pilots in 16,000hr of flying, and steamed a distance of 48,000 miles. After she completes her present tour of duty in the Mediterranean, her place with the Sixth Fleet will be taken by USS *Enterprise*, and *Intrepid* will be used for anti-submarine warfare.

Rear Admiral Thomas H. Moorer, USN, told the visiting newsmen that the US Navy at present has in operation 15 attack carriers, of which seven are of the *Forrestal* class, three of the *Midway* class

(Left) A burst nosewheel tyre on an A4D that landed ahead of this F4D forced the latter to go round again. (Right) The catapult is released and an A4D, under full power, shoots along the deck and into the air. The catapult is so powerful that if set up vertically it could send a 36cwt automobile more than a mile into the air

An F11F Tiger is spotted for hitching to the port catapult; the jet-blast deflector has been raised behind the aircraft

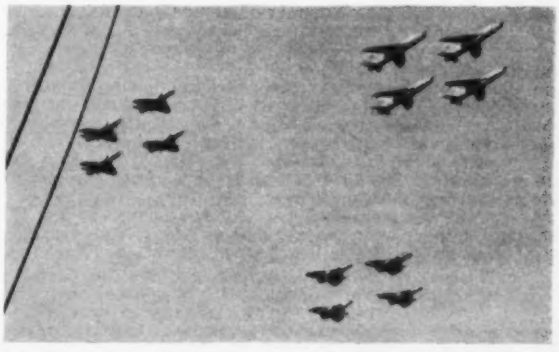
and five (including *Intrepid*) of the *Essex* class. Admiral Moorer is director of the Long Range Objectives Group, which works on plans for the Navy as far as 15 years hence. He said the US Navy is seeking larger carriers for the future. One reason he cited for needing such carriers was the greater safety in their operation. "The aircraft accident rate on a big ship is half that on a small ship," he explained. Accident rates on smaller carriers have been averaging about 44 per 10,000 missions, while on the larger carriers they are only about 24 per 10,000.

USS *Intrepid* is under the command of Capt Charles S. Minter Jr., USN, and Air Group Six, assigned to the carrier, is under Commander James L. Holbrook, USN. For normal operating purposes, the carrier is equipped with five squadrons of 12 airplanes each, plus some spares—usually eight aircraft. The carrier also carries two Boeing-Vertol HUP-2 helicopters, and during take-off and landing of carrier aircraft one HUP-2 is on guard in a position to pick up pilots who may have landed in the water. Two destroyers usually follow behind the carrier on either side during flight operations to assist in such work, if necessary.

Most of the aircraft aboard are jets, including F8U Crusaders (some being F8U-1P versions with cameras), F11F Tigers, F4D Skyrays, A4D Skyhawks, and the familiar piston-powered AD Skyraiders. These aircraft are equipped with a variety of weapons. Sidewinder and Sparrow air-to-air missiles scored two hits out of two against parachute flares, and Bullpup missiles were fired against underwater targets. Techniques for delivering free-falling atomic and thermonuclear weapons included "over-the-shoulder" delivery, and the release of the bomb near the top of a steep climb, with the aircraft and the bomb describing parabolas in opposing directions. These manœuvres are designed to deliver a bomb on a target as long as 60sec after release.

Two catapults, on either side of the forward deck, are used for launching jet aircraft, although propeller types make a run over most of the length of the deck. Normal recovery of aircraft averages one every 30sec during a working day, and one every 60sec at night under instrument conditions. On a few occasions, when everything went right, recoveries have averaged one every 26sec. The average is affected mainly by how fast the angled deck can be cleared of aircraft that have landed.

Should an aircraft have a tyre burst on landing—as happened during the demonstrations for the writer's benefit—the next one or two jets in the landing pattern have to go-around until the deck can be cleared. Most of the jets usually touch down at a speed of around 140kt, and they must catch with their hook one of the five arresting cables strung across the deck. The British-developed mirror sight is highly valued; the traditional "batsman" is used only as a stand-by.



(Upper right) F8Us, F4Ds and A4Ds sweep above "Intrepid" just before breaking formation preparatory to landing. (Lower left) A Crusader is brought to a halt by the arrester cable. (Lower right) A Skyhawk, with extra fuel tank under its belly and bombs under its wings, stands ready for take-off

THE FLYING SPRINGBOK

An Appraisal of South African Airways

BY DARYL NORMAN MAY

ALTHOUGH the four-legged springbok is in some danger of extinction, the flying springbok, or rather the airline recognized by this emblem, can look forward to a rather more rosy future: South African Airways recently brought out a belated report [reviewed on page 488 of this issue] for the financial year 1959-60, showing a profit of £616,672.

It was not so long ago that all sorts of gloomy prophecies were being uttered about the prospects of the airline. If jets were not ordered SAA would be uncompetitive, and if they *were* ordered there would be impossible load factors to meet; there were political issues which threatened air services over the rest of Africa; there was piston equipment to be disposed of; and, to crown it all, there was a loss (for the first time in years) of £158,000. It was not surprising, then, that SAA entered its first year of jet operations with little confidence.

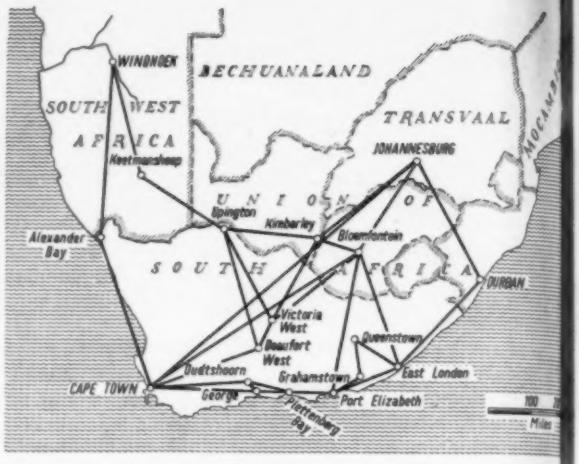
That they have emerged from this period with a profit that many airlines ten times as large cannot equal leads one to probe a little deeper into the airline's affairs in search of the secret of their success.

The first thing that comes to light is the fact that SAA is only a part of a very large nationalized concern that runs South Africa's railways and harbours, and even operates ships. Sometimes a nationalized concern of this type will either serve the public and run at a loss, or not serve the public and still run at a loss. But there is as yet no sign of this happening in South Africa. Probably because the country is expanding at a fast but *predictable* rate, there is no call for cut-throat competition and no excuse for neglect. Even though the airline makes a profit, its load factors are not high enough to provoke a charge of monopolistic neglect; in fact, in many districts it operates services that are uneconomic.

Within this vast transport industry the airline is accounted for separately, but this does not mean there is no co-operation between the different parts. All airline passengers on domestic services are allowed 60lb of baggage free by rail, apart from the normal air allowance. There is also co-operation in a less positive sense in that there are never any disputes about licences and never any wrangles over "material diversion." No matter how the traffic is carried, the transport organization profits, and this fact allows it to get down to the business of seeing that the passenger gets the best service, whether by rail or by air.

Another advantage of monopoly in the airline business is in re-equipment. Without competition, SAA need not risk its future each time it decides on a new type of aircraft. Instead it waits until a type is well proven in service before it buys, and the aircraft is then made to last for a decade or two. Thus in 1947 SAA was the last airline to buy DC-4 Skymasters, but today these aircraft are still in service and likely to remain so.

It was with this philosophy that SAA bought the Viscount 813 and put it into service in the beginning of 1959, several years after most other airlines. The seven Viscounts are now the pride of the domestic fleet and are considered "the best thing SAA ever had." Although airlines often use superlatives when describing their equipment, those that SAA uses to describe the Viscounts are no mere platitudes: "The reliability of the Rolls-Royce Dart engines . . . has surpassed all expectations. The airframe too proved most successful and measured up to all the claims made for it." It is known that the airline is satisfied with the after-sales service, and its Viscount utilization rate is high.

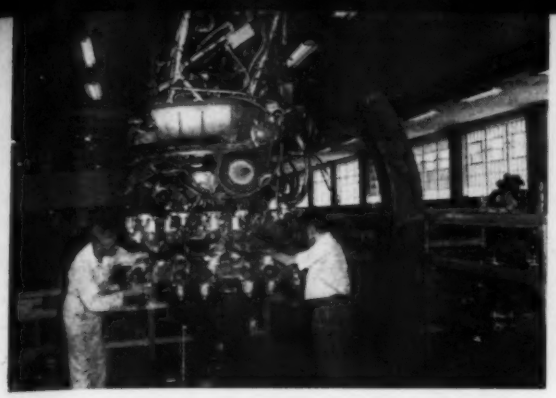


South African Airways' domestic routes

When the Viscount first entered service in South Africa the air-travelling public were impressed by the fact that it did not need to run its engines up before take-off; nor were they slow to appreciate its quietness and speed.

With Viscounts in service, SAA was left with surplus piston equipment that was difficult to sell. It was quick to find a solution in its Skycoach services, using DC-4 Skymasters and offering fare reductions of up to 33 per cent. The most important thing about Skycoach is that it has created traffic, because the normal services have suffered no diversion. Once the popularity of the scheme had been established, services were stepped up with the addition of DC-7Bs, which were retired from the Springbok service to Europe.

A Boeing 707-320 of SAA. Introduction of these big jet aircraft has revolutionized the airline's operations—and also set some problems



Two views of the maintenance base at Jan Smuts Airport: left, the engine overhaul shop; right, radio overhaul

The second plan SAA has for its piston equipment is charter. The airline does not oppose independents like Trek, who operate low-cost services to Europe, and in return the independents have chartered or bought surplus aircraft from SAA. This process is probably not quite as gentlemanly as some comparable ones in Britain, because the independents may never have got their licences if they had not co-operated in the required manner.

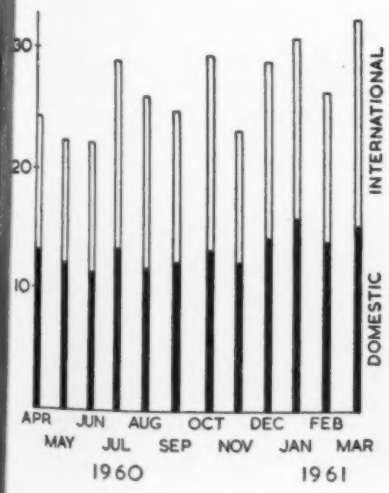
SAA still manages to use piston equipment on her Wallaby service to Australia. Probably Qantas find this route equally useful, as the latter's Super Constellations match SAA's DC-7Bs in obsolescence.

Another important aspect of the domestic operations is weather. This is so good that flights are not cancelled on more than about five days a year, something which perhaps only Australia can rival. The weather also dictates the holiday-season pattern, which is quite different from that of Europe. Though holidays are not concentrated into any one period there is a tendency for them to be taken in mid-winter and at Christmas. This means that the peak-period graph is much less variable than elsewhere; and it is particularly steady on domestic operations. SAA find this fact useful in maintenance, as overhaul can be carried out consistently without reference to season.

Airports Although SAA receives no direct government assistance it does nevertheless benefit from an airport authority which charges low landing rates and runs at a loss of about £1½m a year. The airline may claim that most of this loss is attributable to the cost of maintaining airfields on the routes that it operates uneconomically and at low frequency in the public interest. This may well be so, but it is a factor that needs watching; it is just one of a number of different ways in which an airline may be subsidized without an actual transfer of money.

The main international airport is Jan Smuts at Johannesburg and there are others capable of handling big jets at Bloemfontein, Durban and Cape Town. Apart from these there are 140 public airfields and, as the country is so "hot and high," fifteen or so have runways of over 6,000ft. At the four main airports just mentioned, there is a total of about 35,000 movements a year, involving over 600,000 passengers and 7¼m kg of freight.

One problem which is peculiar only to South Africa came to light in a recent Transport Commission report. The siting of an airfield in the Orange Free State is being held up "due to the uncertainty regarding the location of future mining development in the area." No one wants an airfield to be uprooted because it is over gold!



This graph shows the steadiness of SAA's domestic traffic throughout the year. South Africa's consistent holiday weather is an important factor

Re-equipment Wrangles No report of this kind can possibly be complete unless it conveys details of the factors surrounding the choice of the aircraft and engines the airline buys. In this context the purchase of the Boeing 707 with Pratt & Whitney engines is especially interesting.

When it was decided to order jets the 707-320 was chosen mainly because it is able to fly from Europe to Africa non-stop, a requirement necessary in view of the threats of some African states to curtail landing rights. Although it has never been admitted officially, the best airliner for SAA's services was probably the Comet 4, as it is tailor-made for the traffic density and length of sectors of the Commonwealth routes. It is interesting to speculate now whether or not SAA would have bought the Comet had there been any suggestion of increasing its range by re-engining it with Speys. It would certainly have been better from a maintenance point of view, as five Comets would ensure much greater flexibility than three 707s. In addition, overhaul and spares facilities could have been pooled with BOAC.

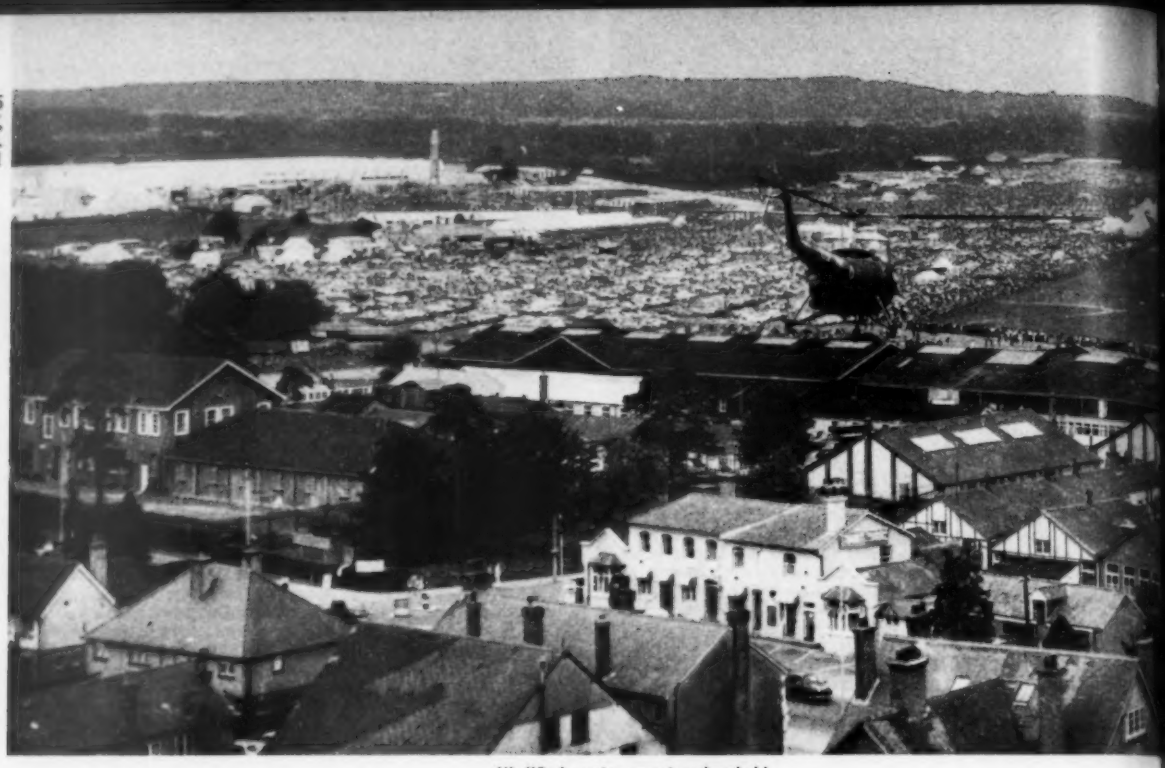
Still, all this is just idle speculation now that the 707 is in service and earning money. SAA backed the introduction with an intensive advertising campaign which has undoubtedly done good. The fact that the national airline was flying the fastest and biggest jets to Europe must have appealed to a large section of the community who do not usually go abroad. Even though the number of international flights was down in the calendar year 1960, passenger-miles went up by over 21 per cent to a record 131 million. Those large Boeing freight-holds attracted 5½ million ton-miles of freight, which is a remarkable increase of 110 per cent on the previous year's figure. Incidentally, these figures come from the Bureau of Census and Statistics, which publishes much more precise details than will ever be found in SAA's report, and also publishes them a full twelve months earlier. The peak-period graph is drawn from figures supplied by the Bureau.

Although the airline's financial results for 1960–61 will not be officially available for another year, the Bureau has released details of revenue and expenditure to show that the airline will make a profit for this period of some £600,000, about the same as the previous year's figures. More encouraging still are the estimates now before Parliament for 1961–62. These forecast a 25 per cent increase in revenue to £13m and past experience suggests no reason to doubt these estimates.

The economics of SAA's services have undoubtedly proved better than the airline's most optimistic forecasts, but there have been other snags to take away most of the glory. When an airline operates fully half its 45,500-mile network with only three airliners it is seriously inconvenienced if things go wrong. The Springbok service to Europe with the Boeing 707 is in just this position. In October last year a 707 belly-landed at Nairobi; in January there was an overshoot at Zurich which damaged the undercarriage; and the most recent incident occurred in August at Athens, when, for reasons not yet published, one of their 707s became airborne at the extreme end of the runway, suffering damage from a brick wall and some trees. No injuries resulted from any of these mishaps—and the overall SAA safety record is still very good—but no airline can continue having incidents like these every few months.

In connection with the first of these occurrences, it is pertinent to record that the Boeing Company flew out a team of no fewer than 80 engineers to get the machine flying again and into service without too much delay.

Beyond these rather sensational incidents there is nothing else that is particularly remarkable about SAA. It is a comparatively small international airline doing a very capable job of serving the public through passenger and taxpayer alike. And when we come to consider that these are the only real criteria of an efficient and successful national airline, we must realize that SAA is just that.

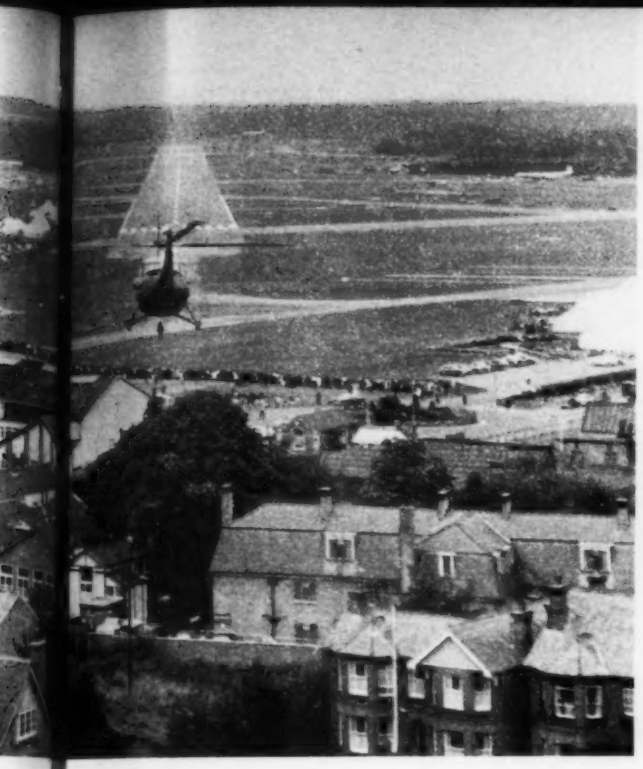


(*1*) "*Red section crossing threshold . . .*

Eight Skeeters go to the Show

(*2*) "*Crossing-over . . .*

(*3*) "*. . . now*



(5) "... go

over-leaf change ...

(6) "Line abreast ...

(7) "... odd numbers up, even numbers down"

A PIQUANT item in the SBAC Show was the formation display by eight Skeeter Mk 12s of the Army Air Corps. Flying in from east and west in two sections of four (1), they crossed over (2 and 3), torque-turned at the ends of the runway, did a changing clover-leaf pattern (4 and 5), went into line abreast for a backwards take-off, turned left into two sections of four for another crossover, torque-turned, went towards each other, stopped, then formed line abreast and bobbed up and down (6 and 7) in front of the president's enclosure before turning smartly left and marching off. Team leader was Maj Stuart Whitehead, and flying with him in Red section were Capts Mike Sharp, John Tarran and John Heath. In Blue section, led by Maj Peter Richardson, were Capts Colin Watts, Jim Dawson and Paul Walters. Pilots and aircraft were from the Army Air Corps Centre at Middle Wallop. Ian Macdonald of "Flight" flew with Maj Whitehead on the last day of the show—when 100,000 people attended—to take these pictures.

FIFTY YEARS OF JAPANESE AVIATION

THE present time, give or take a few years, is being made the object of a number of fiftieth anniversaries in aviation. Air mails in Great Britain and naval aviation in the USA spring to mind at once; and now a profusely-illustrated work from Japan records the major features of that empire's aviation history over the half-century from 1910 to 1960.

To be true, the chronological part of the work (*Nihon no koku goju nen*; Kantosha Co, Tokyo; exported by the Maruzen Co at US $18.75) tells us that two ornithopters were flown in 1785 and 1787; perhaps Mr Gibbs-Smith will look a little more closely into this one day! However, the book concentrates mainly on powered flight, and as gliders and free balloons are not exhaustively covered, the first picture is of Capt Yoshitoshi Tokugawa at the controls of an Henri Farman biplane, when he made the first powered flight in Japan on December 19, 1910. He received the French Aero Club's pilot licence No. 289 at the Camp de Chalons on November 8, 1910.

A hint as to the unknown, forgotten treasures that may still be hidden in the world's museum basements or long-locked garages is given by a 1960 photograph in which Lt Gen (retd) Tokugawa is seated at the controls of the *same 1910 aeroplane*. It had been preserved, taken to the USA after the 1945 surrender, and returned to Japan last year.

There is no doubt that several major collections of aeroplanes in Germany, Italy and Japan itself were destroyed by bombing and looters during the Second World War. However, although some life-size *memorabilia* and many official records were lost, sufficient private material evidently remained for the complete story of Japanese air development to be told very comprehensively in this work. Private and official sources are said to have contributed some 10,000 pictures, of which 910 were selected. They are especially valuable for the early years, when many "one-offs" and private ventures were built; the military aeroplanes from about 1925 to 1945 are now well enough known from other sources, of course, but receive good treatment in accordance with the spirit of the book.

The birth of Japanese Army aviation in 1911, and of the Navy's air arm in 1912, is shown by pictures of various imports as well as of Japanese-built aeroplanes. The Services collaborated to build an airship in 1911, but Isaburo Yamada had already built two in the previous year. France and America were the major suppliers to Japan before 1914. Pictures from that year include some of the Nieuports and Farmans which attacked the Germans at Tsingtao. Apart from such rarities as these, the book gives us pictures of the Ozaki biplane (1917) which was later sold to Ataman Semenov in Siberia, and of an American-made Christopherson biplane, assembled in Japan, which was furnished to Sun Yat-Sen for his air corps during the fighting in the remnants of the Chinese empire.

After Tsingtao, Japanese aviation had no great part to play in the war, but the well-known reorganization after 1919 saw large numbers of French and British aeroplanes imported into Japan. Good illustrations of numerous Sopwith, Spad, Nieuport, Farman, Breguet, Salmson and other types are given, while at the time the first Nakajima and Kawanishi aeroplanes also appear. Many British aircraft were furnished to the Navy, and are also illustrated.

Older readers will recall with nostalgia that the 1920s and 1930s were the heyday of international non-commercial flying. The editors claim that their book illustrates not only every powered aeroplane to have been built in Japan, but also all those which visited the island empire. First visitors after the war were two Ansaldo SVAs from Italy in 1920, and later came Argentinian, French, British, Soviet (Gromov, 1925), Italian, Danish, Czech and even Latvian fliers! Quite a number of the globe-trotting aeroplanes of the time, including Japanese ones, flew across Siberia, apparently without let or hindrance—an impossibility today! Lindbergh, Amy Johnson, Wolff Hirth and Dr Eckener all appear in these pages.

At a later date (1942) an Italian SM-82 (photo 622) reached Japan after a "secret flight via China." Details of the route from Italy to China would no doubt be fascinating. Perhaps it involved a flight from Western Russia over Iran, Afghanistan and Tibet?

The Dornier acquisitions of the 1920s are illustrated, as well as the aeroplanes designed by Dr Vogt (misspelled "Fogt") for Kawasaki.

To pass over the remaining part of the book briefly, because the later warplanes and the post-1945 developments are so well known, is not to say that nothing new or valuable is to be found here, for the remainder of the 810 photographs in this section are a fine compilation which give a very thorough coverage. The last part of the book, illustrated with 100 smaller pictures, contains a history of Japanese aviation and a chronological survey, and again the earlier material is of very great value.

Students whose acquaintance is only with Indo-European languages need not be too dismayed at the fact that *Nihon no koku goju nen* is printed in Japanese, because although the illustrations alone are worth the price of the book, the set includes two smaller English-language volumes entitled *The Fifty Years of Japanese Aviation*. Book I provides detailed translations of the captions of the 810 major photos, and Book II has a key to all 910 pictures, plus a translation of the historical and chronological sections.

The compilers, Katsu Kohri, Ikuo Komori, and Ichiro Naito, worked under the guidance of Gen Tokugawa, Admiral Hideho Wada and Dr Hidemasa Kimura, designer of long-range monoplanes. They have produced a reference work of which they and purchasers of the volumes may be justifiably proud.

D. J. V.

BEGINNINGS OF THE TRACTOR BIPLANE

THE following notes on the very earliest tractor biplanes are from the forthcoming new edition of Charles H. Gibbs-Smith's book "The Aeroplane—an Historical Survey." We quote the chapter in full for the period up to the end of 1910; after that it goes on to deal with the two years that produced such famous types as the Avro biplane, which first flew in April 1911. Many of the aircraft mentioned are illustrated in the book.

THE dominant type of powered aeroplane through the maturing period of practical aviation—say 1910 to 1925—was the tractor biplane with a long fuselage bearing the tail-unit. The beginnings of this type deserve special mention and diagnosis.

It was in 1905 that the first tractor biplane appeared in Ferber's No. 6 aircraft, which was really a powered glider, with a forward Wright-derived elevator, ineffectual wing-tip rudders, and a fixed rear stabilising tailplane: the tractor airscrew revolved between the elevator outriggers. The outcome was not powered flight but shallow-powered gliding; but it was the beginning of the tractor tradition, and the beginning of the stable biplane tradition as opposed to the deliberate instability which the Wrights adopted.

In 1906 came the Blériot III, which never flew, and which—in this first of many modifications—had two tractor airscrews driven by one engine. Also in 1906 was Ellehammer's tractor semi-biplane (one main wing with a loose sail attached above) which made some short hops round a circular course when tethered; it had no forward elevator, only a rear tail-unit, and was the first tentative biplane to dispense with the Wright-type forward elevator; but it never made a free take-off or flight. In 1907 Santos-Dumont built his No. 15 aircraft, a rather odd small-size variant of his famous canard '14-*bis*' box-kite biplane, but going 'airscrew first'. It never flew, but was the first 'proper' tractor-type biplane to have no forward elevator.

It was also in 1907 that there appeared the unsuccessful, but influential, biplane built and tested by de Pischoff at Paris. This was a tractor biplane with a Cayley-type tail-unit, and no forward elevator, which may fairly be said to be the pioneer of the modern configuration tractor biplanes, although it lacked a fuselage. During December 1907 and January 1908, it made five hops, the best being of 80 metres (262½ feet), but could not sustain itself in the air. However, it was seen by most of the pioneers of the day and undoubtedly led to the subsequent more sophisticated and successful tractor biplanes.

In 1908 came the first tractor biplane to make significant hop-flights, Ellehammer's No. 4 machine: this was in June, when at Kiel it was the first aeroplane to fly in Germany: it had a rear—not forward Wright-type—elevator, but it was a somewhat eccentric machine and was neither influential, nor much known to contemporary inventors, nor practical.

Soon after, in July 1908, came a better-known machine in the form of Ferber's No. IX (the *Antoinette III*), which made good hop-flights from July to September: as a configuration it did not exert much influence, but it helped to focus attention on the tractor biplane as such. Mention should also be made of Cody's 'British Army Aeroplane No. 1' (which made its first flight on October 16th 1908) but only because it was a 'near-tractor', with the two propellers revolving in between the biplane wings; otherwise it was largely Wright-derived.

The true establishment of the modern tractor biplane configuration came with the Goupy II biplane of 1909, which first made a hop-flight of 200 metres (656 feet) in March: it had staggered wings and a long fuselage supporting the tail-unit. This machine was not successful, but was soon followed (still in 1909) by the Goupy III which was similar in appearance; this was flown successfully by Ladougne in 1910, including flights at the Doncaster meeting in September: good photographs of both machines appeared in French and English journals, and the influence of the type was widespread.

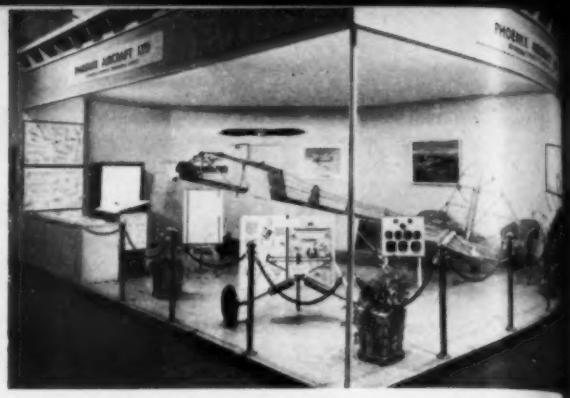
Also in 1909 came the first Breguet tractor biplane, which started tests in June and was flown with some success at Reims in August, where it crashed on its third flight: this machine was backward-looking in that it had large tail outriggers, and a Voisin-derived nacelle for the pilot. Still in 1909, at the end of the year, the Voisin firm produced an unsuccessful tractor version of their box-kite biplane.

The year 1910 saw the successful and well-published flights of the Goupy III, and also the excellent new Breguet; the latter may be said to have consolidated the tractor fuselage-type biplane tradition. These Goupy and Breguet machines were clearly the inspirers of most tractor biplanes thereafter. There were, of course, other tractor biplanes designed and even built in 1910, but the only one of these which was fairly successful was that built and flown near Geneva by the Swiss pioneer brothers Dufaux.

Bristol's Tenacious Bulldog

RESTORED to flying condition by Bristol Aircraft Ltd, and with its Jupiter engine rebuilt by Bristol Siddeley Engines Ltd, the Bulldog single-seat fighter depicted on this page has been presented by Bristol Aircraft to the Shuttleworth Trust. The handing over took place at Filton on September 12, and the principal participants are seen on the right. They are, l to r, Mr J. F. Harper (director and general manager, Bristol Aircraft Ltd), Air Cdre A. H. Wheeler (Trustee of the Shuttleworth Trust), Mr C. F. Uwins (deputy chairman of the Bristol Aeroplane Co Ltd), Mr R. L. Ninnes (special director, Bristol Siddeley Engines Ltd), and Mr B. A. Chalmers (secretary, Bristol Aircraft Ltd). The presentation was made by Mr Uwins, who was Bristol's chief test pilot from 1919 to 1947, and who remembers the Bulldog among the 50-odd Bristol aircraft types flight-tested by him during that period. The aircraft carries the markings of No 56 Sqn, RAF, and the Service number K2227. Dating from the early 1930s, the Bulldog can certainly be classed as a veteran, though it can give several years to the rebuilt Bristol Fighter, from which the above picture was taken and which is just discernible in the background to the group photograph.

Guest of honour at a Royal Aero Club dinner on September 12 was Maj H. A. Petre, seen here (left) with Miss Diana Barnato-Walker and Col C. F. H. Gough, chairman of the Club



The Phoenix Aircraft stand at the recent Do-it-yourself Exhibition at Olympia. On show were W. G. Cooper's Luton Major fuselage and Roy Goodwin's Luton Minor undercarriage

Sport and Business

FOR THE FIFTH successive year the National Glider Aerobatic Contest is to be held at Dunstable, and will be organized by the British Gliding Association in conjunction with London Gliding Club. During the aerobatic contest a race around a 100km closed circuit will also be held. The contest begins at 11 a.m. on Sunday, September 24.

DIFFERENT ASPECTS OF GLIDING have been well covered in two recently published books, directed respectively towards the newcomer to the sport and the soaring pilot. One is a practical introduction to the basic ingredients of gliding, and the other a lucid account of the subtle science of meteorology.

In *Tackle Gliding This Way* (Stanley Paul and Co, 178-202 Great Portland Street, London W1, 12s 6d), John Simpson has written a meaty, no-nonsense handbook which effectively conveys his long experience as a gliding instructor—and shorter experience, with the boys of Leighton Park School, as a glider constructor. The book should be included, together with the weatherproof clothing and liver salts, in the baggage of all would-be pilots setting off for their first holiday gliding course. Had it been available, it would certainly have been recommended by this reviewer's first gliding instructor. His name was John Simpson.

No met-man is better known to the British gliding community than C. E. (Wally) Wallington, who not only pioneered detailed, high-quality weather forecasting at national championships—incidentally making possible the striking advance in contest task-setting over the past five years—but also displayed his committed approach by learning to glide. Gliding meteorology is essentially a practical science, and *Meteorology for Glider Pilots* (John Murray, 50 Albemarle Street, London W1, 25s) shows that Wally Wallington is an articulate practitioner as well as a skilled one.

"A sound appreciation of meteorology and of the forecasting service does not, of course, automatically raise a pilot to top class in the soaring world," Mr Wallington states in his preface, "but it can add considerable interest to his sport, it can forestall many potential hazards, it can help him to perceive and use extra soaring opportunities and it can make him feel more at home in the air." One might add that, *without* such an appreciation, no pilot *can* reach top class in the soaring world.

The broad meteorological scene is set, without specific reference to gliding, in the first nine chapters of the book. Aspects relevant to soaring flight are amplified thereafter in chapters devoted to low-level airflow; sea breezes; the tephigram; convection; showers; thunder and lightning; thermal soaring prospects; lee waves; wave soaring; the altimeter; more about fronts; and "weatherwise"—a most useful guide on getting the most out of the available weather-information services. An intelligent grasp of the main points in the chapter on thermal soaring prospects is a must for thermal-hunting pilots, and Mr Wallington's detailed description of the sea-breeze front lays the foundation for an extensive exploration of this narrow-belt lift phenomenon.

K. T. O.

Posed by Mark Lambert to show its 1961 colour scheme (still dominantly Cellon's white, pale grey, dark blue and fluorescent orange) is "Flight's" 14-year-old Gemini 3A. This much-used and endearing vehicle will be replaced next year by a Beagle Airedale which, in its turn, will be superseded by an M.218—the Beagle company's specially tailored Gemini replacement

ED CLARK'S GIPSY MOTHS

Ed Clark and (right) his surviving Gipsy Moth, constructed by de Havilland and assembled in the US by Moth Aircraft Corp in 1929

Right, Clark's first Moth, which came to grief during a film sequence in 1956

IF the law of averages had prevailed in the case of the D.H.60, the last Gipsy Moth would have been written off the US register years ago. While this remarkable airplane (writes an American correspondent) enjoyed immense popularity throughout the British Commonwealth during the late 1920s, it was only moderately successful as a commercial venture in the US, where it was assembled (and later manufactured under licence) by the Moth Aircraft Corporation, a subsidiary of Curtiss-Wright.

Until seven years ago, however, there were at least two British-built Gipsy Moths still knocking around California. These were registered NC916M and N236K, the latter being owned by Ed Clark of Hawthorne, California. While N236K was operated primarily for its owner's pleasure and amusement, it paid its own way. From time to time the aircraft was hired out to various motion picture studios for use in aviation pictures, including *The Lindbergh Story*, *Tarnished Angels* and *They Came To Cordura*.

It was in such employment that the Moth abruptly terminated its lengthy career. Hank Coffin, a well-known stunt pilot, was hedge-hopping it during the filming of an Abbott and Costello comedy. Preoccupied with watching the signals of the camera crew hovering above in a helicopter, he failed to observe a telephone pole directly in his path. The Moth embraced the pole with terrific force and disintegrated. Again the law of averages was over-ruled: more or less intact, Coffin extricated himself from the debris, mumbling something about where in the heck could he find another Gipsy Moth to finish the film.

Although the Moth was his pride and joy, Ed Clark is a philosophical individual and accepted the loss of his aged biplane with equanimity. He remembered seeing a derelict D.H.60 north of San Francisco and immediately set out to negotiate with the owner. Within twenty-four hours he had another Gipsy Moth, which was flyable except for an asthmatic engine. Fortunately, the engine from N236K was undamaged and it was quickly installed in the newly acquired NC916M, which was then flown back to the filming site to finish the sequence without further incident.

In spite of the fact that supervision of his machine shop keeps him busy six days a week, Clark manages to get in a few hours of flying every other weekend. He keeps the Moth at a small airport just outside Los Angeles in a 10ft-wide shed between two normal-size hangars. Of course, the wings have to be folded and unfolded.

Whenever there is a fly-in meeting of the Antique Airplane Association, Clark usually makes it a point to show up with the Gipsy Moth, and invariably the little biplane flies away with a trophy or two. Sometimes, when the fly-ins are held in distant cities or east of the Rockies, the Gipsy Moth goes by trailer.

During the 1960 West Coast AAA Fly-In, Clark and a passenger were in formation with a Davis D1W parasol of about the same vintage and four other relics of a generation past. They were flying close, almost within hand-shaking distance. Just as the group was breaking up, a gust of wind caught the Davis and its fuselage struck the Moth's upper wing on the starboard side, cracking the forward spar and crushing several ribs. The Davis and its horrified pilot wobbled off to the airport with a sizeable hole in its side.

Clark and his companion, who were wearing parachutes, at first contemplated abandoning the venerable Gipsy Moth. But a few minutes' investigation of the controls and handling characteristics indicated that the odds were still stacked in the Moth's favour, and, anyway, the parachutes were nearly as ancient as the airplane. Clark and his companion decided to stick with the Moth for better or for worse and an emergency landing was safely accomplished.

Now in its thirty-second year, the Moth is still hale and hearty and its 90 h.p. Gipsy I ticks off the r.p.m. as smoothly as ever. Clark has acquired a stock of spare parts sufficient to keep it in the air indefinitely, so it may be a long time to come before the last American-owned Gipsy Moth retires "with wings forever folded."

THE POPULAR FLYING ASSOCIATION'S two-day international rally, held at Fairwood Common airfield, Swansea, on September 9 and 10, drew over 30 aircraft, including a seven-aircraft French contingent. Among the French pilots was Monsieur M. Beraud, president of the Réseau du Sport de L'Air, the French equivalent of the PFA, who carried off the *Concours d'Elegance* trophy with his Jodel D.199. Mr Norman Jones of the Tiger Club arrived in the prototype Condor to learn the happy news that he had been awarded the new Challenge Trophy presented to the PFA by the Royal Aero Club for the individual making the greatest contribution during the year in the cause of light aviation.

The award for the best-constructed ultra-light aircraft at the rally went to the Hertfordshire Experimental Group (operating from St Albans) for its Turbulent. At the presentation of the trophies Mr David Armstrong, PFA chairman, said that over 90 members from all parts of the country had joined in the rally, and their support was indicative of the growing strength of the Association. Over 100 affirmative replies had been received following the Association's referendum on the possibility of a PFA-organized charter flight across the Atlantic to link up with the Experimental Aircraft Association.

The programme on the first day, carried out in brilliant sunshine, was to include a fly-off for the Masefield Trophy between the McAully Group and the Armstrong Whitworth Group, but this event had to be postponed because of magneto trouble in the AWA Group's Tiger Moth. A major part of the landings competitions were completed, however, and there was a good deal of local flying over the Gower peninsula. Unfortunately, torrential rain brought the programme to a halt on the second day of the rally.

Straight and Level

BRITISH United's new Britannia "Safari" services to Africa, due to be introduced on October 1, will go non-stop from Gatwick to Entebbe, cutting out the whistle stops made by the Viscount. To promote these new services, British United's advertising boys have hit on the slogan "Thru-Liner Safari." The new service will, they say, be flown by "All-Star Britannias."

I, Roger Bacon, Defender Of Our Mother Tongue Against The Onslaught Of Americanese, am thru with advertising copywriters who copycat Madison Avenue. Thru-liner—ugh. It really is a bit off. And what in Heaven is an All-Star Britannia?

It is dreadfully un-British United of British United. Why don't they really go thru with it—like this, perhaps: "*Folks, You Will Love Our New Golden Deep-Fried Safari Service. Fly The Amazing Astro-Flite 75 Oven-Fresh Real Tree-wood Britannia . . .*"

● Here is another airline advertising slogan which is good English but, it seems to me, not very good business. "Be Pampered By Pakistan International Airlines," it reads.

Throughout the world, airlines embarrassed by over-capacity are desperately trying to find people to fill up seats. The only way they can do this is by appealing to the masses of would-be air travellers who, for cut-price fares, don't want to be pampered—new passengers who will increase the airlines' volume of business and . . . well, everyone knows the argument.

Actually, PIA have just made a profit for the second year running (see page 488). Perhaps if they are to continue to do so their commercial manager ought to have a word with their advertising manager.

I press the middle valve down,
And the Skeeter goes round and around . . .

● Further details are now available of the new Crimson Leak surface-to-air missile designed by Scruggs Aircraft to be fired from horseback by officers of the Household Cavalry, riding side-saddle. After trial rounds of a private-owner surface-to-surface version for fox-hunting (code-named Blue Blood and equipped with a guidance system of blinkers and reins) have been fired over Sir John Blackout-Jones's Yorkshire estate, the definitive version will go into production. A new type of bearskin will be issued to the Household Brigade, externally the same but incorporating a stiffening of plastic foam filler inside to enable the guidance system computer to be accommodated underneath without the soldier losing both his bearskin and his composure on ceremonial parades.

On top of each bearskin is a delightfully chic little rotating dish-type scanner, designed in co-operation with Hamish Haute-Mode, Straight and Level's fashion consultant, which is guaranteed to give a time-honoured uniform an extremely modish touch that not even the most blasé débutante is likely to ignore.

● As part of a "resourcefulness contest," 17-year-old Michael Whittier of Highgate School recently wrote to Air France in London and asked for a round-trip ticket to Paris. In exchange he promised to write an article about his trip and get it published in the British press. If it were not published, he offered to work without salary for a week in Air France's London office. I quote Air France: "The deal was made, and Michael had his short fling in Paris . . ."

I imagine that a burly IATA enforcement officer will shortly be flinging himself at Air France's door. Because, as gents of the Press are so often told by airlines, free trips in exchange for write-ups are, in the eyes of IATA—and I think quite rightly—a deadly sin. Thinks: If I could write I would ask Air France for a free trip too.

● More people went to the National Gallery to see the blank space on the wall where Goya's Duke of Wellington had been than went to see the actual portrait before it was stolen. Tut tut for public values.

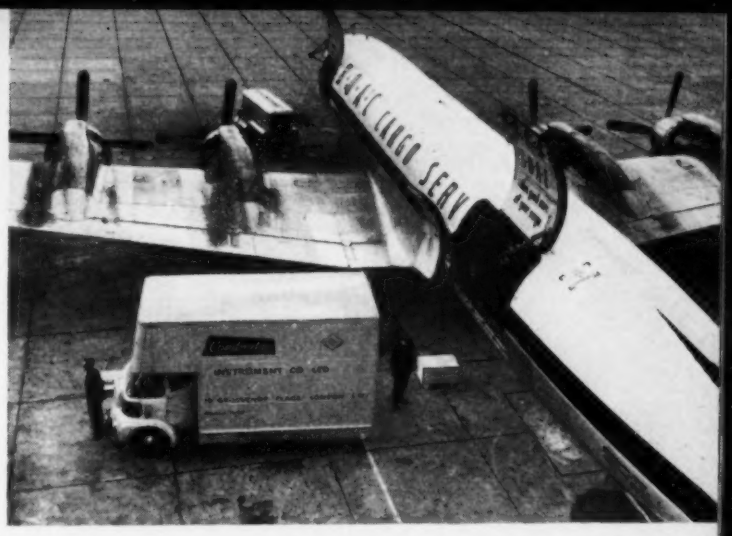
More space was devoted by the newspapers to reporting that the Aviation Traders Carvair prototype had been damaged by a carelessly driven lorry than was devoted to the first flight of this aircraft. Tut tut *tut* for newspaper values.

ROGER BACON

. . . I flap my wings up and down,
But she won't get off the ground . . . [Mr M. Walton, 23, of Taunton, attempting to make a man-powered flight with his flapping wing machine at Creech Barrow on September 10]

BOAC's two DC-7Fs, say the corporation, have so far produced financial results "better than had been anticipated." Loads on services between the UK and Canada and the USA have included textiles, machinery, motor car parts, shoes, livestock, small aircraft and aircraft engines

AIR COMMERCE



SUPERSONICS AT HAMILTON PLACE

THE eighth Anglo-American Aeronautical Conference—referred to elsewhere in this issue—was the occasion for a number of papers and some discussion on the problems of supersonic air transport.

Mr R. G. Thorne, of the RAE's Mechanical Engineering Department, in his paper "The Influence of Some Operational Problems on Supersonic Air Transport," emphasized that no real datum exists for assessing supersonic airliner economics, since present methods for assessing costs are based on subsonic operations. An important task for the economists is a much more detailed examination of the way costs are built up when a new aircraft is added to a complex network. The supersonic aircraft is about twice as sensitive to operational restrictions such as holding or altitude limitations than a subsonic jet, or about four times as sensitive if extra fuel for these restrictions has to be found by off-loading payload.

It was, said Mr Thorne, difficult to foresee devices that would reduce the basic engine noise without prohibitive performance penalties. The supersonic aircraft should be about 3 PN db noisier during the ground roll and 4 PN db quieter under the throttled climb path than a subsonic jet. Changes in engine and airframe design, to reduce significantly the sonic boom intensities under the cruise path, were unlikely to afford an economic solution.

With regard to cabin conditioning, in the past the systems designer has had at his disposal a large source of heat in the engine compressors and an infinite heat sink—the atmosphere. With a supersonic airliner, the heat sink must be carried in the aircraft and any errors in assessing the sink's size will result in a penalty on the aircraft. Cosmic radiation will not constitute a hazard for operations below 70,000ft unless exposure times greater than 200 hours per year are likely. So crew members in a Mach 2-2.5 aircraft and regular travellers in Mach 3 aircraft may have to be treated as radiation workers and subjected to routine medical checks on the effects of cosmic radiation. The recent resumption of Russian nuclear tests may create hazardous radiation conditions above the tropopause and special filtration may be needed. Radiation apart, the most uncomfortable moment for the supersonic passenger will undoubtedly be the use of reverse thrust on landing. Fuel accommodation will pose some tricky problems; it will be housed in wings of relatively smaller area and thickness than at present so that all space, no matter how awkwardly shaped, will serve as a fuel tank. Fuel may tend to gravitate towards corners from which it has to be almost completely collected and pumped at a very high rate. It may already have been heated aerodynamically to near boiling point, giving rise to the possibility of vapour locks.

BEA's GOOD AUGUST

BEA's summer holiday traffic, which was below expectations in July, recovered during August. Lord Douglas, writing in the *BEA Magazine*, says that extra sales effort may be bearing fruit. Passenger traffic in the first three weeks of August was 15 per cent up on the same period last year, despite the Government's latest restrictions on credit.

At BEA's recent annual press conference (*Flight*, August 31) Lord Douglas referred to the difficulties at present being experienced by the corporation. He now reviews the results for July, and these show an increase in total traffic of 10 per cent compared with July 1960, against a capacity increase of 20 per cent. Load factor fell by six points from 68.6 per cent in July 1960 to 62.7 per cent in July 1961. The provisional profit for July was £1 million, but expenditure and losses this coming winter will have to be contained if BEA is not to record a deficit during the present financial year. Mr Anthony Milward, BEA's chief executive, said at the recent press conference: "If we can hold our losses, if we have good weather and if domestic traffic comes up, we may just scrape through."

"HORIZON" REPORT OUT

COPIES of the "Project Horizon" team's report for the Federal Aviation Agency, just published, were not available at the FAA's London office as this issue went to press, but it is possible from news agency sources to summarize the main points. The report, it will be recalled, was ordered earlier this year by President Kennedy, and its purpose was to set out the long-term goals for the US air transport industry.

America's international aviation policy, the report recommends, should be studied immediately by the FAA, with a view to protecting US international airlines from increasingly intense foreign competition. (This problem is one on which the CAB, with its proposed amendment to foreign air carrier permits calling for traffic statistics, is already working.)

The report also recommends that the US aircraft industry should develop four new types of airliner. In addition to a Mach 3 supersonic airliner, these are: (1) a short-medium range jet seating 60-90 passengers—presumably an aircraft in the class of the BAC One-Eleven; (2) a 250-passenger jet to serve high-density routes such as New York-Washington; and (3) a true all-freight aircraft.

The report urges that the US should go ahead with the construction of five new airports—at Miami, New York, Detroit, Chicago and Los Angeles. A further 150 airports are required for private and business flying.

REDUCING TRANSATLANTIC SEPARATIONS

THE fourth ICAO North Atlantic Regional Air Navigation meeting opened in Paris on September 14 for the purpose of revising the North Atlantic regional plan. This plan specifies the provision and location of navigation facilities, meteorological networks, ATC centres, and so on.

One of the objects is to plan the best use of four teleprinter circuits due to become available late next year in the new submarine cable running from Newfoundland *via* Greenland and Iceland to Scotland. A substantial improvement in North Atlantic communications is expected to result, present communications in the region being frequently interrupted by interference from the Aurora Borealis. Better communications will allow existing transatlantic air traffic separation distances to be safely reduced.

UAT AND TAI

AT one time a merger between France's two major independents, UAT and TAI, would have seemed as far-fetched an idea as would a merger today between British United and Cunard Eagle. Yet France's two major independents—backed, like their British counterparts, by shipping interests—have now agreed in principle to merge. TAI are backed by Messageries Maritimes, and UAT by Chargeurs Réunis. It is suggested that TAI will have effective control of UAT, TAI's present capital being doubled by the transfer of Chargeurs Réunis' almost 100 per cent holding in UAT.

The two French independents have been drawing closer together, both operationally and commercially, over the past two or three years. Both companies operate DC-8s—UAT two and TAI three. Services are operated in pool from Paris to Mali, Sierre Leone, Guinea, Senegal, Volta, the Niger Republic, Dahomey, Togo and the Ivory Coast. Apart from these routes TAI operates to Madagascar, while UAT operates to Johannesburg and to North Africa, the Cameroons and Central Africa. TAI's best known route is, of course, from Paris through Asia and Australasia across the Pacific to Los Angeles, linking up with the state corporation, Air France, which operates from Los Angeles to Paris *via* Montreal.

NORTHWEST TRAGEDY

AN Electra of Northwest Airlines crashed, killing all on board, shortly after taking off from Chicago O'Hare Airport on September 17. Confused early reports state the number on board to be 36 or 37, including five crew. Some reports say that the aircraft flew into power cables and crashed about 18 miles west of Chicago. The Electra was operating the service from Milwaukee to Tampa, Fort Lauderdale and Miami.

This page goes to press after page 487, on which is reported the Air France Caravelle accident of September 12.

The golden jubilee of UK airmail services was appropriately celebrated on September 9 by a BEA Westland Whirlwind (Capt J. A. Cameron) which operated a special flight from Hendon to Windsor Great Park. The flight commemorated the first UK Aerial Post flown over this route in the coronation year of 1911. Watching the unloading near Queen Anne's Gate was, left, Mr Harry Hessey, the original messenger in 1911. The helicopter carried 5,000 postcards and 42,000 envelopes, one of which is reproduced above

AIR COMMERCE...

OVERSEAS' FLEET FOR SALE OR LEASE

AN indication of the value of aircraft until recently operated by Overseas Aviation (CI) Ltd, but in recent months transferred to the ownership of Overseas Aviation Ltd, is provided by a classified advertisement of Overseas Aviation Ltd in last week's issue of *Flight*. Argonauts are offered for sale at from £20,000 and North Stars from £15,000, or for lease at £15 and £12 per hour respectively. The Ambassadors, of which Overseas Aviation Ltd has two, are offered at £45,000 each with Check 4s or for lease at £20 an hour. The Vikings, some of which have freight doors, are offered at £4,000 each or £6 an hour lease, and Doves are offered for £12,000 apiece or £15 an hour lease.

If all these aircraft were sold at the above prices, the eight North Stars so far delivered from TCA would fetch £120,000, the five Argonauts £100,000, the seven Vikings £28,000 and the two Ambassadors £90,000, making a total of £338,000.

THE SHEIKH'S OWN ACCOUNT

MEA has resented the "invasion" of the Middle East by BEA, which has had "a detrimental effect on all Arab airlines," and since BEA and BOAC are "both owned and controlled by the same authority," the British refusal to withdraw BEA's competition made MEA's position as partners of BOAC "impossible." It was partly this situation which prompted MEA to make its offer to buy out the BOAC shareholding.

These were some of the remarks made by the chairman of MEA, Sheikh Najib Alamuddin, at a Press conference in the Lebanon on his return from the London meetings at which MEA became independent of BOAC. A full report of the conference appears in the MEA magazine *Lebanon Fortnightly*, dated September 1-15. Details of the actual financial offer are given; though these are in bare outline only, leaving many questions still unanswered, they provide more information than BOAC have hitherto been willing to publish.

This is the offer, as described by the Sheikh. (1) The BOAC 48.5 per cent shareholding (24,216 shares) in MEA was "purchased for cash by a number of Lebanese nationals." (2) The sum owed by MEA to BOAC is not £3.5m, as "inaccurately reported" in some newspapers. The loans due to BOAC, says the Sheikh, total £1.5m, and MEA has agreed to pay these off in equal instalments over five years. There is an Intra Bank guarantee to cover this. (3) There has been a sales agreement between MEA and BOAC for Viscounts. There are still four more yearly instalments due and these will continue to be paid and are fully provided for in MEA's annual budgets. (4) MEA has given BOAC a mortgage on its four Comet 4Cs against BOAC's guarantee of MEA's contract with de Havilland. (5) MEA has bought all the installations of MASCO —the land, buildings and equipment. The price is to be paid partially by cash down payment and the rest by instalments over a period of ten years.

Meanwhile MEA intends immediately to raise its capital from £L6½m to £L15m. MEA plans to enter into "technical and commercial agreements with other Arab and foreign airlines," and is proposing the creation of "one strong United Lebanese Airline."

The first and foremost reason for MEA's offer to BOAC, as given by the Sheikh, was the airline's desire to become financially independent and 100 per cent Lebanese. The Sheikh says that MEA's partnership with BOAC proved a hindrance in concluding pooling arrangements with other airlines, prevented MEA from obtaining the full support of Lebanese authorities, and created difficulties with neighbouring countries with regard to traffic rights and other facilities. Furthermore, plans for the creation of a Pan Arab Airline, long the subject of discussion, were "often slowed down by BOAC's hesitation" as shareholders. Says the Sheikh: "I could cite a number of cases where we have entered into negotiations, but failed to conclude an agreement, between us and Arab states because of the delays and lack of support given by BOAC." But, in conclusion, the Sheikh makes a point of thanking BOAC for the help it has given to MEA throughout the partnership.

Footnote: Lord Douglas, chairman of BEA, said last month in answer to a question about MEA's criticisms of BEA "poaching" in the Middle East: "BEA flies these services for Cyprus Airways, and if the Sheikh gets rid of BEA he will find himself with a rather more tiresome operator on his hands."

EAST AFRICA'S HAYMAKERS

HOT and high is not only synonymous with poor take-off performance—it has also become identified with indifferent financial performance. Yet in a year when airline results were disappointing, two neighbouring airlines in the hot highlands of East Africa never had it so good. On revenues of £4.3m, East African Airways last year showed a profit of almost £½m. Meanwhile its northern neighbour, Ethiopian Airlines, was doing even better, the 1960 accounts showing a similar profit on revenues of only £3.4m. Both airlines show a common background of rapid expansion in recent years, primarily on long haul services to Europe. In each case, profits on the longer-haul routes have not only covered the losses still being made on the domestic networks, but have allowed the development of medium-haul services—in the case of EAAC to Southern Africa and to Aden, Karachi and Bombay, and in the case of EAL to West Africa.

But at this point the similarity ceases, for each airline has gone about its own way to achieve profitability. Whereas East African has gone in for high load factors on pooled services, Ethiopian has based its economy on high revenue rates. The bald facts are that EAAC filled 64 per cent of its output of 25m c.t.m. at an average revenue rate of 60 pence per l.t.m. Ethiopian Airlines, on the other hand, filled 47 per cent of its 21m c.t.m. at an average rate per l.t.m. of 83 pence. On the cost side there are also surprising differences despite the proximity of the overall cost level in each case—EAAC 34 pence per c.t.m., EAL 33 pence per c.t.m. Largely because of its remote location, Ethiopian has to pay an unavoidably high cost for many of its purchases; the price of its fuel, for instance, works out at 6 pence per c.t.m. (over 25 per cent greater than the equivalent figure for EAAC). Nevertheless, because of its intensive use of labour—the influence perhaps of its TWA inspired management—its labour costs work out at only 8.4 pence per c.t.m. as against 10.9 pence per c.t.m. for EAAC. This comparison is even more striking when it is recalled that EAAC rely on their pool partners, particularly BOAC, for much of their activities, and much of what would otherwise be shown as labour cost must be concealed under such items as *charter/hire of aircraft*. Perhaps a clearer way of showing the distinction between the two airlines is to compare the workforces required to turn out only slightly dissimilar volumes of output; EAAC 1,759 employees, EAL 895 employees.

Looking towards the future, neither airline is likely to enjoy a repetition of 1960's bumper harvest. Already this year East African revenue rates will have fallen as a result of the expansion of low rated Skycoach services, and the non-recurrence of last year's remunerative Congo charter operations. The spreading shadow of excess capacity in international air transport will also tend to deflate the load factors on the quadripartite African pool which bolstered EAAC in 1960. These adversities are unlikely to be offset by any substantial reduction in EAAC's unit cost levels for its Comet, Argonaut and DC-3 fleets. Ethiopian Airways appear to be somewhat better placed, for their two Boeing 720s—due to be delivered soon—promise lower costs on the medium- and long-haul

Members of the board of Nigeria Airways recently visited BOAC at London Airport. Their visit was part of a European tour of airlines and manufacturers, as recounted on this page ("Seeing for Themselves"). Left to right: Mr P. O. Chukwueke, director; Mr. J. R. Wardrop, BOAC; Chief J. O. Fadahunsi, chairman; Mr O. Ode, director; Mallam Baba Dara Dara, director; Mr O. Cocker, technical adviser; and Mr F. H. Pearn, production manager, BOAC. According to Rolls-Royce, whose Derby establishment the party visited on September 13, Nigeria Airways intends to buy five twin-Dart airliners—believed to be Friendships (see "Flight," September 7, page 362)—for domestic services

services, this being coupled with higher load factors than have been possible with the airline's relatively uncompetitive DC-6Bs.

But these favourable trends will take some time to take effect, and meanwhile EAL's revenue rates will be sliding downwards. Although high rates could continue in the domestic field (although it is only fair to point out that internal air fares in Ethiopia are cheap compared with surface travel) domestic services will comprise an ever-diminishing proportion of EAL's total business. Like airlines everywhere, EAAC and EAL are likely to find the early sixties an uphill struggle. However, each carrier will be able—thanks to the good fortune of 1960—to set off to a well-heeled start.

FAA CERTIFICATES THE F-27F

THE FAA has issued a type certificate for the Fairchild F-27F executive version, which differs from the earlier F in having an increased maximum take-off weight of 39,400lb (formerly 38,500lb) and a maximum landing weight raised to 37,500lb. Compared with the standard F-27, fuel capacity is increased, and improved pressurization provides a cabin altitude of 8,000ft at 25,000ft. The F-27F incorporates as standard equipment many installations previously offered as optional "extras" on the F-27 and F-27A; the F variant has a longer centre of gravity range. Powerplants are Rolls-Royce RDa.7E Dart 529s. Four F-27Fs have already been delivered this year.

Fairchild is also offering the F-27G, which will have a maximum take-off weight of 42,000lb and a greater range than the F-27F. Most of the flight testing of the G variant has been completed and certification is expected in early 1962.

GOODBYE SHANTYTOWN

BOAC's operations, and those of airlines whose passengers are handled by BOAC, are to be transferred to the London Airport Central area on Monday, November 13. The new long-haul passenger terminal (passenger building No 3, as it will be called) in the Central area, at present under construction, will handle all departures. At this stage only half the building will have been completed, and until the other half is finished in April 1962 arrivals will be handled by the international section of the existing short-haul passenger building, to be known as passenger building No 1. Aircraft already cleared at Prestwick will be handled through the domestic channels of the short-haul building, now designated passenger building No 2.

BOAC should have available by the end of November a large warehouse in the Central area for temporary office accommodation, export cargo, and incoming and outgoing mail. Loading and engineering sections will be temporarily accommodated in huts on the apron. The import cargo section will, for the time being, remain at LAP North and incoming freighter aircraft will continue to be handled on the North apron because of the proximity of the import warehouse. The corporation has Customs approval to handle arrivals and departures at Cranford Lane, due to congestion on the North apron, but this facility will no longer be required once the move to the Central area is completed. If the occasion arises where passenger building No 1 cannot absorb all BOAC arrivals, flights will be diverted to the North apron.

An office block is being constructed for BOAC near No 3 passenger building, into which administrative offices will be transferred in April 1962. The temporary office accommodation which BOAC will occupy in the departure half of the passenger building will be made available for other operators, who should move from the North area in April 1962. An office block for these airlines is due for completion in 1963.

SEEING FOR THEMSELVES

NIGERIA AIRWAYS announce that the directors have concluded a ten-year development programme, divided into two five-year phases: the first entails re-equipment and capitalization of the company; the second will continue with steps towards the complete "Nigerianization" of all the company's activities. These programmes call for the training of Nigerian personnel in all fields of airline operation, and research in the development of air routes to ensure that the company's activities fit in with the interests of Nigeria as a whole. The company intends, within the next few months, to begin construction of a modern engineering base at Lagos Ikeja (an illustration of which appeared in last week's issue), and to establish a planning department.

Such an expansion programme obviously requires first-hand knowledge of how other countries manage their airlines, and the board of directors is visiting some of the world's leading airlines and aircraft manufacturers. They are accompanied by the airline's technical adviser, and the first tour began with a visit to the SBAC show. The party will travel between London and Europe, visiting a number of leading airlines for the purpose of studying their facilities for personnel training, engineering and development. The party is due to return to Lagos tomorrow, September 22.

Footnote: Arrangements were completed last March for the Nigerian Government to assume complete ownership of Nigeria Airways in March 1961. BOAC's 16⅔ per cent holding was transferred to the Federal Government which at the same time purchased the 32⅔ per cent holding of Elder Dempster Lines.

FAA ORDERS CONSTELLATION INSPECTION

AS a result of the TWA Constellation crash near Chicago on September 8, the FAA has ordered eight US airlines immediately to inspect a control linkage on their Constellations and Super Constellations. The airlines concerned are TWA, Eastern, National, Pacific Northern, South Pacific, Flying Tiger, Seaboard World and Slick. The inspection is to ensure that five bolts, nuts and cotter pins in the parallelogram linkage between the elevator boost valve and boost mechanism are "properly secured and safe-tied." A spokesman said that failure of the linkage would lock the elevators upwards and send the aircraft in a sudden, violent climb.

A day in the life of the de Havilland Comet: of 55 Comet 4s, 4Bs and 4Cs whose movements were investigated on Friday, September 8, none was delayed by a technical fault. This board, displayed on the Hawker Siddeley stand on the first public day of the SBAC show at Farnborough, was compiled from cabled messages received at 0800hr that morning from DH engineers and technical representatives stationed with Comets in various parts of the world

THE COMET IN SERVICE

CRAFT	SERVICE	LOCATION & PROGRESS
	B.O.A.C. Comet 4	
APDG	London - Singapore	Karachi on schedule
APDB	Far East - London	Rangoon on schedule
APDE	- -	London maintenance check
APDD	London - Far East	Hong Kong 27 minutes late No technical delay
APDF	London - Johannesburg	London E.T.D. 1800
APDF	Far East - London	Colombo 55 minutes late No technical delay
APDG	London - S. America	London Transit Check E.T.D. 1715
APDG	S. Africa - London	E.T.A. 1140 London on schedule
APDE	- -	London maintenance check
APDJ	London - Australia	London E.T.D. 1500
APDE	- -	London maintenance check
APDL	London - Australia	Singapore on schedule
APDE	Australia - London	Beirut on schedule
APDD	London - S. Africa	London Transit Check E.T.D. 1900
APDE	- -	London maintenance check
APDJ	London - Australia	Singapore on schedule
APDE	Australia - London	Beirut on schedule

CRAFT	SERVICE	LOCATION & PROGRESS
G-APDP	Singapore - London	Switzerland 21 minutes late No technical delay
G-APDR	London - S. America	Rio de Janeiro 55 minutes late No technical delay
G-APDS	London - S. Africa	Via Luso to Central Africa Cleanup Salisbury on schedule
G-APDT	London - Tokyo	London Transit Check E.T.D. 2200
	B.E.A. Comet 4B	
G-APMA	Tokyo - London	On schedule
G-APMB	London - London	London E.T.D. 1850
G-APMC	Nigeria - London	London E.T.A. 1300 on schedule E.T.D. 1500 for Luxor
G-APMD	London - Tokyo	On schedule London E.T.D. 1505 for Colombo
G-APME	London - Copenhagen	London E.T.D. 1155 E.T.D. 1750 for Barcelona
G-APMF	London - Copenhagen	London E.T.D. 1050 E.T.D. 1650 for Nice
G-APMG	- -	London maintenance check
G-ARCO	- -	London Completing maintenance
G-ARCP	London - Australia	London E.T.D. 1120
G-ARCM	London - Tokyo	London E.T.D. 1000
	London -	London E.T.D. 1140

CRAFT	SERVICE	LOCATION & PROGRESS
G-ARJL	London - Zurich	London E.T.D. 1150 E.T.D. 1720 for Frankfurt
G-ARJM	Tel Aviv - London	London E.T.A. 1715 on schedule
G-ARJN	London - Geneva	London E.T.D. 1020
	Olympic Airways Comet 4B	
SX-DAK	Athens - London	London E.T.A. 1540 E.T.D. 1740 for Athens
SX-DAL	Tel Aviv - London	Athens on schedule
G-APZM	London - Athens	London E.T.D. 1210
G-ARDI	Athens - Frankfurt	On Schedule
	United Arab Airlines Comet 4C	
SU-ALC	Cairo - Damascus	On Schedule
SU-ALD	Cairo - London	On Schedule
SU-ALE	London - Cairo	London E.T.D. 1515
SU-ALL	Cairo - Moscow	On Schedule
SU-ALM	Cairo - Paris	Charter Service
	Middle East Airlines Comet 4C	
	Beirut -	Vienna 11 mins late

CRAFT	SERVICE	LOCATION & PROGRESS
OD-ADR	- -	Beirut maintenance ch
OD-ADS	London - Beirut	On schedule
OD-ADT	Beirut - London	Arrived 25 minutes late No Technical Del
	East African Airways Comet 4	
VP-KPC	London - Dar-es-Salaam	London E.T.D 224
VP-KPF	- -	Nairobi maintenance c
	Aerolineas Argentinas Comet 4	
LV-AHN	- -	Buenos Aires maintenance c
LV-AHR	London - Buenos Aires	Dakar, on schedule
LV-AHS	New York - Buenos Aires	Trinidad, on schedule
LV-AHU	Buenos Aires - Frankfurt	Dakar, 30 min late, No technic
	Mexicana & Guest Aerovias Comet 4	
XA-NAR	Mexico City - Los Angeles	On schedule
XA-NAS	Madrid - Mexico City	Bermuda, on schedule
XA-NAT	Mexico City - Paris	Mexico City, E.T.D. 140

AIR COMMERCE . . .

Dr Guido Mancini (left), general manager of Itavia, is seen here with Mr E. Manley Walker, managing director of Handley Page, after the signing of a contract for two Herald 200s. A further note on the sale, recorded last week, appears below

ITAVIA AND THE HERALD

ADDITIONAL details are now available of Itavia's order for two Handley Page Herald 200s, with a third on option, reported in last week's issue. Delivery dates for these aircraft are January and February 1963. Dr Mancini, the general manager of Itavia, in a statement after the contract had been signed, gave reasons for Itavia choosing the Herald in preference to similar types. He said that his company had conducted extensive research work into replacement aircraft for the six Herons (four of which have now been sold) at present operated by Itavia. The airline found that the Herald offered the best proposition from the point of economics and passenger appeal. Results showed that over the company's route the break-even load factor of the Herald was as little as 37 per cent. Dr Mancini stated that his company may eventually operate five Heralds.

Mr E. Manley Walker, managing director of Handley Page, thanked Travelair Ltd, the aircraft sales agents of London, for being instrumental in effecting the sale.

POST CONGO BLUES

A YEAR ago it looked as if Sabena might experience a reduction in traffic for the second year running. Yet the recently published annual report for 1960 shows that the airline's traffic jumped up by as much as 45 per cent. The paradox of this is that it was the Congo crisis—the very factor which threatened to diminish Sabena's business—which accounted for this extraordinary expansion. The brief facts were that in July Sabena was for three weeks galvanized into the emergency operation of evacuating over 34,000 fugitives from the Congo back to the homeland. Excluding this non-scheduled operation, Sabena's traffic showed a moderate increase of 15 per cent.

Although the crisis brought Sabena an unexpected flow of business, it did little to help the airline's strained financial resources. Despite an increase in revenues of over one-third to the equivalent of £31m, the year's accounts showed a £1m deficit. This is all the more remarkable in view of the airline's improved load factor (73 per cent as against 70 per cent in 1959).

The simple fact is that Sabena's costs are still too high to allow profits to be made out of the lowly rated traffic which predominates on the Sabena network. Nor are the prospects bright, for an end is in sight to the high load factors which have recently been a factor in containing the airline's deficit. These high load factors have reflected the near-monopoly situation which Sabena has enjoyed on its services to and in the Congo; on these routes, which accounted for almost one-half of Sabena's traffic, load factors averaged almost 80 per cent. This impending trend towards lower load factors is evident from the 1960 accounts which show a reduction from 70 to 67 per cent on scheduled services, this being because Sabena's scheduled growth was concentrated in the highly competitive North American and European markets where load factors are very much lower than in Africa. That the overall load factor did not decline in 1960 was only due to the remarkable volume of emergency charter business which in one year sprang from being less than one-tenth to becoming one-quarter of Sabena's total traffic.

The swing to more competitive markets also saw a slight reduction in Sabena's average revenue rates on scheduled services from 54 to 53 pence per l.t.m. In this case, the Congo airlift had a detrimental effect on the expansion of low-rated non-scheduled business, and pulled down the overall revenue rate by 6 per cent from 52 to 49 pence per l.t.m. Another factor which also exerted a depressing effect on Sabena's revenue rates was the reduction in mail traffic which resulted from the political changes in the Congo.

Undoubtedly the most encouraging aspect of 1960 was Sabena's ability to reduce its cost level by 10 per cent. This was primarily because the airline managed to push up its capacity by 38 per cent over a period during which it reduced its work-force by two per cent, to 10,500. This remarkable achievement was partly due to the cutting back of Congo native personnel, plus a tight control on other staff, and partly due to the high productivity of the Boeing 707s. In the current year the number of staff has again been on the increase—up to 11,000 by the mid-year—and so any continued cost reduction must depend primarily on the full utilization of the Boeing and Caravelle fleets. This cost reduction is vital if Sabena's financial position is to improve, for it would seem that a cost level of over 30 pence per c.t.m. will not allow profitable operation on Sabena's network over the next few years.

It is probably for this reason that the problem of fleet utilization is given prominence in Sabena's latest report. Air Union would help in this respect but the report expresses some doubt as to whether this scheme is likely to see the light of day. In the meanwhile Sabena is extending its sphere by operating services on behalf of Persian Air Services and Aviaco (to the Canary Isles). However, these arrangements seem insignificant when viewed against a growing background of restrictionism in air transport which makes it increasingly more difficult for "have-not" countries such as Belgium to negotiate satisfactory traffic rights.

SKYCOACH FARES CUT

SKYCOACH fares offered to British residents by BOAC and Cunard Eagle between the UK and Bermuda and the Caribbean are to be reduced, subject to ATLB approval, for the winter months October 1-March 31. Without the reductions a rather absurd situation would have arisen; two of these colonial cabotage fares, those to Bermuda and the Bahamas, would have been higher than the special 17-day excursion economy fares applicable from October 1 to March 31. The proposed reductions to the other points, Jamaica, Barbados and Trinidad—to which no 17-day winter excursion fares are applicable—have been made to conform with the reductions to Bermuda and Nassau.

UK to:	Present Skycoach return fare	New Skycoach return fare	Economy-class 17-day return winter fare
Bermuda	£130 0s	£114 6s	£114 6s
Nassau	£162 0s	£152 18s	£152 18s
Kingston/M'Bay	£176 8s	£160 4s	—
Barbados	£187 4s	£171 0s	—
Trinidad	£198 0s	£178 4s	—

Skycoach services to British colonial points began on October 1, 1960, operated by BOAC, Cunard Eagle and British United (*Flight*, October 7, 1960, pages 559 and 560). They were introduced, it will be recalled, as the result of a BOAC challenge to IATA two years ago, when the corporation—publicly backed by the then Minister—said in so many words: "Agree to the extension of economy fares or we will exercise our right to go it alone with low fares on our colonial cabotage routes." In the event, a compromise led to reduced IATA fares and the introduction of low-frequency Skycoach services by the British operators.

According to BOAC's 1960-61 report, Skycoach services have "so far engendered a limited public response." The new reductions may increase Skycoach business in the areas concerned, although many passengers to Bermuda and the Bahamas may be attracted during the coming winter months by the comparable 17-day economy excursion fares, which include a meal (for which Skycoach passengers pay 7s 6d) and offer a better baggage allowance. Of course, Skycoach passengers are not limited to a 17-day stay, and furthermore it is proposed that they be allowed to make one part of their trip outside the October 1-March 31 period by availing themselves of one half of the new Skycoach winter return fare.

Though perhaps not, from the taste viewpoint, everyone's cup of China tea, this interior of Civil Air Transport's one and only Convair 880-M is certain to satisfy the needs of comfort. Promoted as the Mandarin Jet, the aircraft links Formosa with Hong Kong, Tokyo, Bangkok and Seoul

Likely-looking lads seen here being introduced to their living quarters by AVM E. C. Bates, principal of the College of Air Training, Hamble, are the first seven of BEA's cadet pilots who have just begun their training

CARAVELLE TRAGEDY

A CARAVELLE belonging to Air France crashed seven miles south-west of Rabat on September 12, killing all 72 passengers and six crew on board. According to the control tower at Sale Airport, Rabat, the weather was foggy and flying conditions poor as the Caravelle came in to land. It was in radio contact with the tower at the time of the accident. The Caravelle was on a flight from Paris to Casablanca. Except for the tail assembly, which remained almost intact, and a 12ft section of the fuselage, the aircraft was completely wrecked.

A later report stated that the Caravelle was flying low, over thick fog, towards Rabat Airport with undercarriage down when its wheels hit the summit of a hill. Marks on the ground and a trail of debris showed the airliner had ploughed a furrow for about 300yd before plunging into a deep ravine.

This was the third major airliner accident this month, and it brought the total number of airline accidents in 1961 involving passenger and crew fatalities to 28, and the total killed to 912.

LUTON LOOKS AHEAD

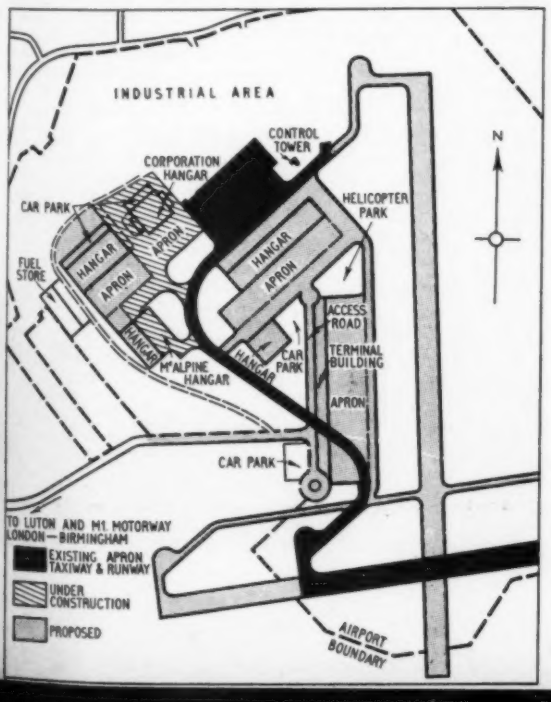
A CONFERENCE was held at Luton Airport on September 8 by the Luton, Dunstable and District Chamber of Commerce in conjunction with Luton council's airport committee. The meeting was convened to draw attention to the facilities offered by Luton Airport, and was formally opened by Dr Charles Hill, MP for Luton.

Mr H. T. Rushton, the airport manager, reviewed the already excellent facilities at Luton and outlined a million-pound five-year development programme (see the illustration below) on which work has already started, and which will be completed if sufficient use is made of the airport. The concrete runway is 5,532ft, has a bearing strength of LCN 45, and land will be purchased at the eastern end of the runway to enable an extension of 1,250ft to be made. A full visual glide-path indicator (v.g.p.i.) system is installed, as well as high-intensity runway, threshold and approach lighting. Other navigational aids available are a Marconi AD 200 DF and Decca 424 radar.

Other speakers were Mr P. W. Brooks, BEA's fleet planning manager; Mr H. C. L. John, KLM's freight sales development officer; and Mr G. H. Threlfall, managing director, Autair (Luton) Ltd. All three reviewed the present position in their particular fields, and estimated future potential growth at Luton. Mr H. J. Colman of Hawthorn Baker Ltd, a local business firm, recounted the facilities that exporters would wish to see when using the airport. Mr Brooks and Mr Threlfall put forward their ideas; the essence of these was that Luton should concentrate on developing charter and executive flying to form a basis on which scheduled services could be developed. Derby Airways have laid some of the foundations and operate a few scheduled services from Luton, and Autair are building up a growing charter business.

Part of Luton's success to date has been due to large resident aircraft manufacturers—for example, Hunting Aircraft Ltd, Napier, English Electric—who provide a steady income. Luton Airport is 500ft a.m.s.l. and because of its altitude is not greatly affected by fog, being therefore a useful diversion airfield for the Midlands and London. Mr Rushton said he expected KLM to make an announcement shortly nominating Luton as their diversion airport for London. As to the question whether Luton will become London's third airport, this appears to be too early to determine. Mr Brooks said: "It will be some years before there is traffic saturation at Heathrow and Gatwick."

Luton enjoys excellent communications with London and the Midlands, due to the proximity of the M1 motorway (30 miles to London), and frequent railway services to London, Birmingham and the Midlands. With Luton's central position and accessibility to major population areas, it is ideally sited for serving an area north-west of London, whose accessibility to other airports is limited by time and distance.



The diagram shows the five-year development plan for Luton Airport (see text). Planned extensions to the concrete east-west runway will increase the total length by 1,200ft to 6,732ft

£6,000 FOR ALL AIR PASSENGERS

IT was on June 22 last that the Royal Assent to the Carriage by Air Act, 1961, was signified in the House of Lords, thus enabling the United Kingdom to ratify the "Hague Protocol" of 1955 and thus in due course "amend the Convention for the Unification of Certain Rules relating to International Carriage by Air signed at Warsaw on October 12, 1929."

A minimum of thirty skilfully-managed ratifications is necessary before the Hague Protocol can come into force. Ratification by the UK will bring the present number of ratifications to around 20; hence it is clear that some time will elapse before English lawyers and air transport operators need become familiar with the details of this latest Act.

Although the Protocol effects 17 main alterations to the Warsaw Convention, there are perhaps four changes of major significance:

(1) Raising the normal limit of liability of the carrier from 125,000 Gold Francs (roughly £3,000)* to 250,000 Gold Francs in the case of death, injury or delay of a passenger.
(2) Clarifying the definition of the carrier's "wilful misconduct"—which, if proved to have been the cause of the damages suffered, will remove from the carrier the protection of the normal limits of liability contained in the Convention. In these circumstances damages are only limited by the general law relating to the assessment and remoteness of damages.
(3) An extension of the benefits of the Conventional limits of liability to servants or agents of the carrier acting within the scope of their employment.
(4) A uniform simplification of the minimum vital characteristics of passenger, baggage and cargo documentation. If a relevant document is not issued, or if the issued document fails to contain a compulsory statement relating to the applicability of the Convention—then in either of these circumstances, the carrier will again be unable to invoke the protection of the normal limits of liability.

The Carriage by Air Act, 1961, also contains provisions (Section 10) which would enable the amended Convention to be

* Which may be compared with approximately £1,000 in 1929.

Eyebrows were raised by the appearance, on Westland's stand at the recent SBAC Show, of a Rotodyne in British United Airways colours. As one of the world's biggest helicopter operators, BUA are obviously interested, but no order is at present contemplated

AIR COMMERCE...

applied (with or without modification) to carriage which is not international in the sense of the Convention. The Carriage by Air Act, 1932, contains a similar provision which was used in 1952 and 1953 to apply a modified and streamlined form of the Warsaw Convention to non-Warsaw carriage in the United Kingdom, Channel Isles, Isle of Man, Colonies, Trust Territories and Protectorates.

Consideration of Clause 10 gave rise to the only real excitement in the passage of the Bill, when a proposal to *double* the Hague limit of £6,000 when applied to non-Warsaw carriage was narrowly defeated by 30 votes to 29 at the report stage in the House of Commons on April 21, 1961. At the Committee stage in the House of Lords, Lord Denning drew attention to a clause which has remained unused since October 12, 1929: ". . . by special contract, the carrier and the passenger may agree to a higher limit of liability" (Article 22).

If air carriers agreed to insert in their ticket conditions higher limits of liability than those in the Convention (or even agreed that there should be no limits at all), 95 per cent of litigation relating to carriage by air would disappear in all countries—except perhaps for a determination of the *amount* of damages. BEA already pay up to the £6,000 limit (without admitting liability), just as if the Protocol was already in force. [See remarks by Mr Henry Marking, secretary of BEA, in the Royal Aeronautical Society *Journal* for July 1961, page 471.]

It is stimulating to think that, without any legislation whatsoever, air carriers could voluntarily increase or remove these limits of liability which have been such a bone of contention since 1929. Of course IATA members ought to be the first to consider this.

SPRINGBOK REPORT

JUST received is the annual report of South African Airways for the financial year 1959-60. Although the appearance of the latest report (a year later than most airline reports for the same period) is much improved compared with previous issues, the contents remain deficient. Traffic and operations statistics are rudimentary in the extreme; for instance, no capacity ton-mile figures or load factors are quoted, and financial data are limited to two items described as revenue and expenditure. No effort is made to break these latter figures down. For what the figures are worth, the report notes that revenue in 1959-60 rose by 13 per cent to £9.7 million while expenditure rose by only four per cent to £9.1m, thus converting a deficit of £158,000 into a surplus of £617,000.

Broadly speaking, what happened in 1959-60 was that schedules remained at the slack 1958 level—it will be recalled that the Union suffered from a severe economic recession in that year—but that in the second half of 1959-60 the traffic started to move ahead and load factors as a result were improved. At the same time a tight control was kept on staff strength, the work-force being kept down to 2,750. Together these two factors contributed to a much better financial result than had been possible in the previous year.

A close study of the report shows that the traffic improvement was limited almost entirely to the domestic services. That this was a continuation of a recent trend is shown by the distribution of passenger traffic. In 1956-57 the domestic routes bore 113 million passenger-miles, the equivalent figure for international services being 121m. But by 1959-60 the domestic figure had grown to 143m, and in the process overtook the international traffic, which increased only marginally to 124m.

This expansion of domestic traffic appears to have been a direct result of the long overdue introduction of second-class Skycoach services on the three main trunk routes from Johannesburg to Durban, Port Elizabeth and Capetown. Following an application by Protea Airways (an associate of Trek Airways) to operate cheap services for non-Europeans, SAA extended their Skycoach operations in 1959 by the inauguration of a low-fare DC-3 service for non-Europeans between Johannesburg and Durban. By comparison with the growth of domestic passenger traffic, domestic freight and mail are negligible and slow-growing. This is a possible instance where SAA's efforts may have been inhibited by their close connection with the railways, their parent.

The traffic picture might well have changed sharply in 1960-61 with the introduction of Boeing 707s and economy-class fares on the European services. It is to be hoped that this revolutionary year will see the standard of reporting and accounting brought up to the high level which characterizes this airline's standard of operation.

A feature article on South African Airways appears on pages 474-475.

PIA MAKES A PROFIT

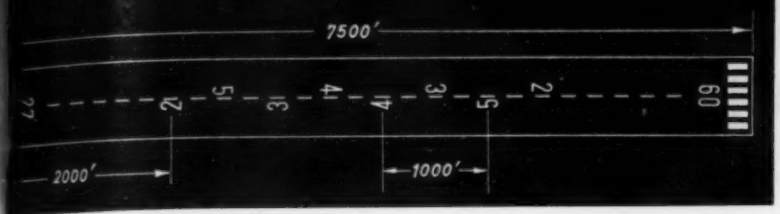
PAKISTAN International Airlines have the good fortune, in an era of excessive jet capacity and falling load factors, to be able to report a profit for the second year in succession. Net profit for the year ended June 30 was about £750,000; during 1959-60, in which financial year PIA made a profit for the first time, the figure was £470,000. Budgeted profit for the current financial year is £1,050,000.

These results are a tribute not only to good management, but also to the success of the 707 lease arrangement with PanAm. With 40 departures every day, PIA has set a new record of 89 per cent on-time departures during the first six months of this year, a creditable record for an airline still in the throes of re-equipment. In the last two years, Viscounts, Friendships and 707s have been introduced, and in that period PIA has spent more than £335,000 on flight crew and engineering staff training. With the introduction of PIA's three Boeing 720Bs next year, Frankfurt and Cairo are to be added to the international route network.

PIA's international network in West Pakistan is to be extended to serve Hyderabad, Sukkur, Dera Ismail Khan and the Makran coast as soon as airfield facilities at these places are available. The airline is also conducting a survey in East Pakistan on the feasibility of helicopter services there, and earlier this year introduced "walk-on" services to Chittagong. Boeing 720Bs will be introduced early next year on the inter-wing service between East and West Pakistan, making Dacca only 2hr and 40min flying time from Karachi; Air Commodore Nur Khan, managing director, points out the time for this 1,500-mile sector is about the same as a Hyderabad-Karachi road journey of 95 miles direct.

PIA's operations run virtually the whole gamut of commercial air transport, from prestige services with big jets down to short-haul walk-on services and the Rawalpindi-Kashmir freight run which provides mountain-locked Kashmiri communities with virtually their only link with the outside world. All these operations bear the stamp of one of the most progressive airline managements in the East.

Logging his 25th year of service with Air-India this year is Capt K. R. Gazder, the airline's manager of transatlantic operations. At present based in London, he has flown 17,000hr in 28 years' flying



As related in a note on this page, the MoA is proposing to experiment with numbers painted on runways. The figures, indicating thousands of feet to go, will be 100ft by 5ft, and positioned about 10ft to the left of the centre line in each direction. The first figure will not be closer than 2,000ft from the threshold; the last will be the figure 2, located 2,000ft from the upwind end

AIR COMMERCE...

WHAT CHANCE FOR SURFACE OPERATORS?

ARE surface operators wasting their time objecting, at hearings before the Air Transport Licensing Board, to applications for new air services? So far, British Railways have considered that their time in the Board's courtroom has been well spent, and their objections have been forcefully argued before the men whose duty it is to "further the development of British civil aviation." Whether they will continue to do so may very well depend on the report of the commissioner, Sir Ralph Hone, who heard an appeal by British Railways on September 14 against a licence granted by the Board to Morton Air Services on the Swansea - Birmingham route.

If the appeals commissioner recommends to the Minister that the Board's decision be upheld, and the Minister accepts this decision, British Railways may well decide to make fewer future appearances at the objectors' table in Therese House. The report may therefore be of considerable historic importance, not only to British Railways, but also to those road operators who have been lodging objections to new air services.

Mr G. H. P. Beames, representing the British Transport Commission at the recent appeal, said that he opposed, in the most strenuous manner possible, the *unlimited* operation of a return service by Morton between Swansea and Birmingham. He felt that the railways were entitled to some protection, as they would be expected to convey the passengers when aircraft were grounded, as they may very well be in the winter. Mr D. W. Robinson, for Morton, said that his airline's service was designed for businessmen who were prepared to pay a little more to travel by air, to save time. The 116 miles between Swansea and Birmingham took about four hours by rail compared with one hour by air; and he submitted that British Railways was not providing a service for the type of passenger who would use the air service.

HOW FAR TO GO

OPERATING experience of jets and turboprops with long landing runs has shown the need for the pilot to have a quick measure of distance-to-go along the runway. Such information would not only save expensive wear on brakes, but would also help the pilot to determine whether a landing can be made safely from the decision point on the approach.

In the past, various methods of helping the pilot have been tried—mainly by means of boards at the side of the runway. But these have been least successful in poor visibility, when of course they are most needed. Now the Ministry has completed trials with numbers painted on a taxiway near Runway 5 at Heathrow, supplemented by tests on a simulator, and the results justify tests in everyday airline operation. When the design of the figures has been completed—it is hoped by the end of this month—they will be painted on selected runways at Ministry airports. It is expected that Runway 5 at Heathrow will be the first to be so treated. Ministry of Aviation *Civil Aviation Information Circular* No 76, September 13, 1961, refers.

BREVITIES

The Philippine Government will sell its majority interest in Philippine Air Lines and withdraw its control over the company.

Since the first Sabena Caravelle service was operated on February 18, 1961, these aircraft have made 1,786 flights and flown 4,818 hours; some 90,000 passengers have been carried.

The FAA is to convene an industry-Government conference in Washington on December 5 and 6 to discuss technical problems associated with the supersonic transport.

For a 12-hour period on October 14-15 all commercial and general aviation flights, as well as non-participating military flights, will cease throughout the USA (except Hawaii) and Canada because of the North American Air Defence Command (NORAD) exercise "Sky Shield II."

Saudi Arabian Airlines has ordered two Boeing 720B medium jets; these two were originally ordered by Ethiopian Airlines, which has reordered the same number for delivery in October and November next year because construction of the new jet airport for Addis Ababa has only just begun. It is also announced that Ghana Airways have cancelled their order for two Boeing 720Bs.

Iranair and Persian Air Services are to merge to form a new company, United Iranian Airlines. The merger, which has been under discussion for a long time, is covered by a governmental decree dated August 2 and will become effective on November 2. It is not yet clear whether Sabena, which has been providing technical assistance and equipment to Persian Air Services, will continue to do so for the new airline.

IATA announce that transatlantic operators, in order to allev.ate the no-show problem, are to introduce a reconfirmation rule requiring passengers to confirm their seats not less than 72hr before departure. This will apply also on the trans-Pacific routes between the Far East and North America. A reconfirmation rule has been in effect for two years in North America and in Europe.

Mr W. Martin-Hurst, a director of the Rover Co Ltd, has been appointed a member of the Welsh Advisory Committee for Civil Aviation. Two new appointments to the Northern Ireland Advisory Committee are Air Marshal Sir George Beamish, KCB, CBE, and Councillor S. R. Cochrane, JP, who is a member of the Tourist Board and Chairman of the Transport Committee of Londonderry Corporation.

The Jordanian Government has suspended the services of Air Jordan, because, it is said, this carrier made an illegal flight from Cairo to Stanleyville in the Congo in August. The Air Jordan aircraft was seized by UN troops at the request of Mr Cyrille Adoula, Congolese Prime Minister, but was later released. A Jordanian Government announcement said that a new national airline would start operations soon, and a new carrier, Jordan Airways, in which MEA has a 35 per cent interest, has been licensed to run services in place of Air Jordan. The latter is to sue the Jordanian Government.

Mr Leon Balcer, the Canadian Minister of Transport, has stated in answer to a question in the Canadian Parliament that Britain has not yet given approval for CPAL to fly to London.

The Civil Aeronautics Board has called the presidents of the 12 largest US airlines to a meeting in Washington on September 28 to discuss the financial crisis now facing the industry.

Derby Aviation's fleet currently consists of eight DC-3s; according to evidence given at recent Air Transport Licensing Board hearings the company is negotiating for the purchase of DC-6s, DC-4s and Argonauts.

The FAA is to install the v.g.p.i. (visual glide path indicator) system at 37 additional airports, having a year ago adopted this RAE system as a national standard. Sylvania Electric Products Inc are to provide major components for the FAA's new installations.

An Ethiopian Airlines DC-3 on charter to the American Coronada Petroleum Corporation crashed in jungle country east of Addis Ababa on September 5. Of the 16 passengers on board, one was killed and three, together with the stewardess, are reported missing.

Gross take-off weight of the Canadair CL-44 has been increased by 5,000lb to 210,000lb, extending the full-payload range by 11 per cent, and the payload with full fuel by more than 15 per cent. Flying Tiger may increase its order from ten to 15.

Aerolineas Argentinas has just ordered, through Douglas, three Caravelle 6s with an option on three more, becoming the first airline to order both Comets and Caravelles. It is not clear whether Aerolineas regards the Caravelle as a replacement for its Comets or for its DC-6s.

An operating profit of £298,510 for the year ended March 31, 1961, was recorded in the NZNAC annual report tabled in the New Zealand House of Representatives. After allowing £121,685 for interest on capital and loan advances, plus provision for taxation of £125,342, the net surplus was £51,483. The year's operating revenue was £5,118,128.

The proceedings against Overseas Aviation (CI) Ltd brought on behalf of WAAC (Nigeria) Ltd were in respect of handling services in Nigeria, and not in respect of three Herons as suggested in *Flight* for September 7, page 362. These aircraft were bought from WAAC (Nigeria) Ltd by Overseas Aviation Ltd and have been fully paid for. They were later purchased by the Admiralty.

The RAF has been asked to investigate a report that the Kalinga Air Lines DC-3 that vanished on July 10, 1960, while on a charter flight for Gulf Aviation between Sharjah, Oman, and Doha, Qatar, had crash-landed on the remote Kuria Muria islands off the Oman coast. The crew of three and 13 passengers, including a known arms smuggler, are said to have been held prisoner; the aircraft was carrying £60,000 in rupees for the Sharjah Bank.

Air Freight and British Trade

By KENNETH R. SEALY and PETER C. L. HERDSON

Part 2

THIS is the second instalment of a summary, specially prepared for "Flight" by the authors, of the recent European air freight study made in collaboration with Hawker Siddeley Aviation by the London School of Economics. Part I appeared on pages 458–460 of "Flight" last week.

THIS section of our study deals with air freight as part of the distribution process; and in order to meet the requirements of detail it is restricted to the export of machinery to Europe. Included under this heading are vehicles, instruments and "miscellaneous metal manufactures" (e.g., cutlery and tools). The data cover that part of distribution which follows despatch from the factory or warehouse to the customer. From the manufacturer's point of view the "consumer" may be an agent in the country of destination, or he may be the final customer. The tracking down of the individual customers of agents was not always possible in the time available. Nevertheless, many problems occur between the arrival of the goods at the port or airport of destination and the final consumer, particularly where the latter is not situated close to the port. The added transport necessary for final distribution may demand well-packed goods, and thus nullify any savings in this direction made possible by the use of air freight. Cases of this kind were found.

We are primarily concerned with total distribution costs rather than with transport costs alone, and some definition seems warranted. Direct elements of cost include transport costs for all journeys, including (e.g.) movement from factory to packing centre and to the port or airport of origin. In addition, packing costs, insurance, documentation, dock dues and Customs must be added. Indirectly may be added the saving of interest made possible by the smaller quantity of capital in transit when air transport is employed. An allowance for the latter has been made, using an interest rate of 5 per cent per annum.

The term "consignment" is used to denote a typical consignment regularly shipped by the firm concerned, based in most cases on data for the past three years at least. A final sample of 100 firms was used, from which some 150 "type" consignments could be documented in sufficient detail. On an annual basis these consignments account for 5,000 shipments (approximately equal to a 2 per cent sample of BEA's annual consignments in machinery). In selection no attention was paid to transport methods used, but since machinery was chosen because of its importance to air freight, we were reasonably certain of getting data for air freight as well as for surface transport. In the event, air freight was used for 35 type-consignments, equal to about 1,200 annual movements. In summary, we are dealing with regular shipments, for despite the fact that emergency shipments probably account for about 20 per cent of current traffic, it is upon a firmer basis of regular usage that the future of air freight must rest.

We may here digress a little to note one or two points concerning "emergency" movements, lest anyone should think that they will die out in the future. The term "emergency" is not a very precise one, since it embraces not only true emergency consignments like the proverbial ship's propeller—but a much wider element of irregular shipment involving spare parts, tools and stock that are premeditated by firms and are therefore not emergency in character. The distinction is between "episodic" and "periodic" movement, and the boundary must necessarily be somewhat arbitrary. "Episodic" implies a lack of regularity; and, where no recurring pattern of shipment over a number of years is found, we have classed the consignment as emergency and omitted it. The whole situation is dynamic—e.g., a new product may be shipped irregularly at first, and regularly later as the markets become assured. Thus, the emergency or episodic shipment has a rightful place in the hierarchy.

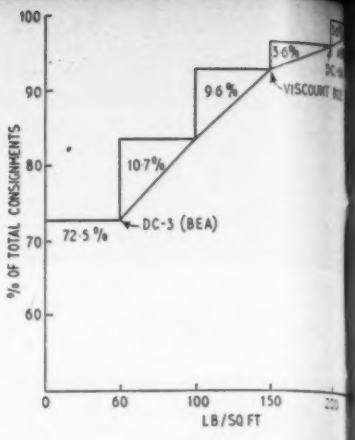


Fig 4. Ability of existing freight aircraft to handle bulky consignments

Consignment Characteristics Forwarding agents and manufacturers pointed out the inability of existing freighter aircraft to carry bulky loads, especially in view of the lack of suitable handling equipment. We found, for example, that of the type-consignments analysed 19 per cent were too bulky to be loaded into the Viscount 802 freighter.

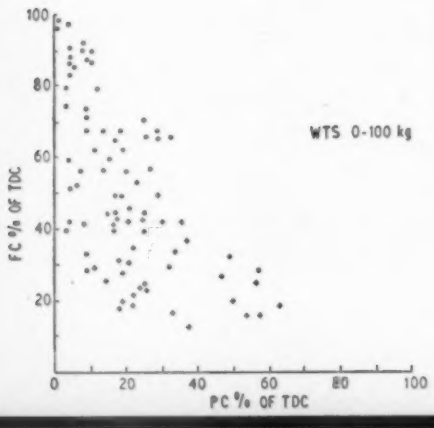
The average density of the air consignments in our survey was 22.9lb/cu ft, while 25 per cent of them were over 1,200lb in gross weight, with an average density of 34.8lb/cu ft. The bearing weights are given in Fig 4.

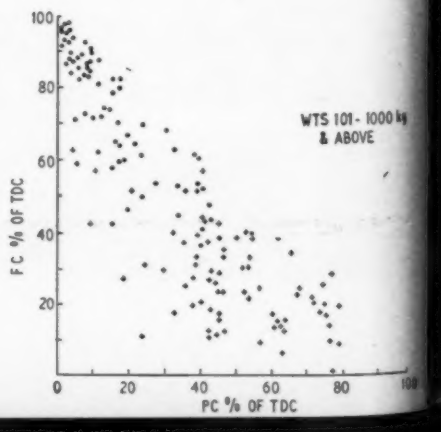
When packed for air as opposed to surface transport, all the type-consignments in our analysis showed an average reduction in total weight of 14 per cent. For those which are currently despatched by air the figure was 29 per cent. Similarly, packing cost reductions would be 25 per cent and 55 per cent respectively. Some 20 per cent of the firms in the survey found no gain in packing when despatching goods by air. This is particularly true of the textile trade.

The export values of the consignments, given in pence per lb, are shown in Table 5. If the figures are made more extreme, by taking out consignments worth more than 1,000pence/lb, then only 5 per cent of the surface shipments would be included, whereas 20 per cent of the air consignments fall into this category. Most consignments are valued at 101–240 pence/lb and it is interesting to note that air freight holds its own despite the relatively low figure.

Attempts have sometimes been made to use the value of a commodity as a means of approximating the level of transport costs it can stand. A figure of 5 per cent of the value is usually taken as a working limit. We calculated both the transport costs and the total distribution costs of our consignments as percentages of their export value. For all consignments the range was 0.2–6.2 per cent for transport costs, and 0.4–15 per cent for total distribution costs. For air freight shipments alone, the figures were 0.5–6.2 per cent and 0.9–7.4 per cent respectively. The average figures for all consignments worked out at 1.7 per cent for transport costs, and 4.5 per cent for total distribution costs. In so far as any average is usable, a figure below 5 per cent would seem more appropriate.

Cost Analysis The relative importance of the various elements of total distribution costs varies with the mode of transport. For surface transport, the two big items are FC, the cost of the main journey, and PC, packing cost (these and other abbreviations are set out at the foot of page 491). Incidental transport costs—e.g., cost of transport to the port—may represent up to 16 per cent of TDC. Other elements rarely reach these levels, but both insurance and documentation costs representing 20 per cent were recorded. In the case of air freight, the great contrast lies in the much smaller figures for PC and the relatively higher place occupied by incidental transport costs. Although seaports may be widely spaced, airports handling freight on any scale are even more sporadic in occurrence; indeed, in many instances, London Heathrow was the only suitable example. Thus some firms in the Midlands and the North use London, thereby adding not only an extra ten hours' journey time, but incurring costs representing 10 per cent of the total. The main





Figs 5a and 5b. Relationship between freight cost (FC) and packing cost (PC) expressed as percentages of total distribution costs (TDC)

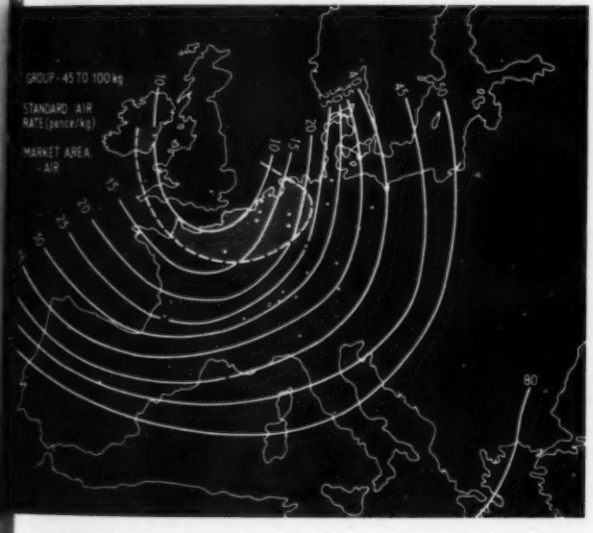
TABLE 5: EXPORT VALUES OF CONSIGNMENTS

Value (pence/lb)	Surface		Air	
	No	%	No	%
Under 100	30	26	1	3
101–240	42	36	15	43
241–480	26	23	6	17
Over 480	18	15	13	37
Totals	116	100	35	100

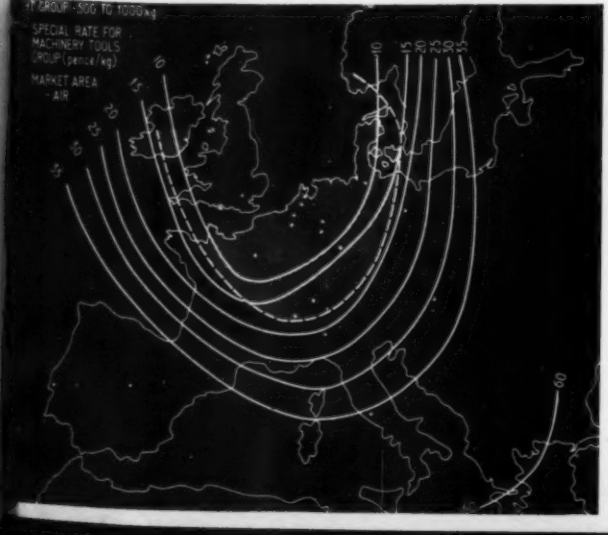
item in air freight is FC (airport–airport), and figures of 80 per cent and over are common. The figures in fact vary with distance; e.g., for the markets lying less than 500 miles from the UK by air, they ranged from 20 to 50 per cent of TDC, but over 500 miles the percentages rose to between 60 and 90 per cent.

Since FC and PC are of greatest significance, particularly in any comparison between transport methods, they have been plotted in the form of dispersion diagrams (Figs 5a and 5b). These diagrams bring out the fact that the cost differential on PC, with respect to air and surface, varies with the weight. This is logical enough, and serves to emphasize the fact that savings on PC when air freight is used apply mainly to the consignments of over 500kg.

A great deal of data were accumulated relating to both air and surface freight rates. It was possible to calculate that the air rate



Figs 7a and 7b. Actual market area for a given air-rate structure, assuming that air freight is used when total distribution cost by air (ATDC) equals total distribution cost by surface (STDC). Fig 7a takes the weight group 45-100kg with a standard air rate whilst 7b takes the weight group 500-1,000kg using a special rate for machinery



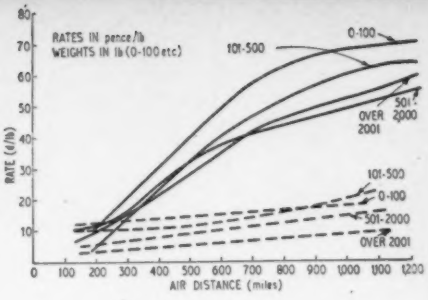


Fig 6. Current air rates (continuous line) compared with rate levels required to equalize air and surface distribution costs (shown by broken line)

should be to equalize air and surface freight costs, and also to equalize air and surface total distribution costs. It was at once apparent that comparisons made on the basis of freight costs alone can be most misleading—and, in fact, very pessimistic from the viewpoint of air freight. Table 6 gives some of the more striking instances. Thus, where the figures in cols 4 and 5 are higher than the current rate in col 3, it pays to use air freight, and *vice versa*.

In some instances the consignment goes by air despite unfavourable cost figures, a reminder that other factors may override. For the type consignments as a whole, there were only five cases where the current air rate was favourable in comparison with the appropriate surface rate, but 23 instances where the ATDC was favourable (including the five favourable on FC alone.) Air freight was, in fact, employed regularly for each of these 23 consignments; the remaining 12 air shipments were anomalous from the cost point of view, and one of these anomalies is given in Table 6. It was too much to expect that all the anomalies would be favourable to air freight, and six consignments were in fact shipped by sea or rail ferry despite the fact that the ATDC was lower than the surface equivalent. Taken together, the anomalies accounted for 12 per cent of the total.

TABLE 6: COMPARISON OF CURRENT AIR RATES AND THE AIR RATES REQUIRED TO EQUALIZE AIR AND SURFACE FREIGHT COSTS AND DISTRIBUTION COSTS (sample figures for machinery, 1960)

Consignment air gross weight (lb)	Destination	Rates (pence per kg)		
		Current rate	Air rate required for AFC, SFC	Air rate required for ATDC, STDC
26	Stockholm	65	21	74 *
72	Amsterdam	16	9	36 *
1,552	Amsterdam	12	4	14 *
10,120	Brussels	6	2	7 *
216	Amsterdam	8	10	39 *
Compare with:				
56	Rome	66	14	23
580	Basle	20	7	4
580	Amsterdam	9	4	4 *
2,600	Stockholm	49	7	14
22,400	Amsterdam	12	1	1

* Indicates that air freight is currently used.

The complete results may be plotted both graphically and by means of maps. Fig 6 compares current air rates with the rate levels that would be required to equalize air and surface distribution costs. It has already been remarked that most shipments by air occur over the shorter distances, and Fig 6 brings out the point that, over these distances, costs are most favourable. When looking at the graph it is as well to remember that exact parity between ATDC and STDC is not necessary. Indeed, an ATDC averaging 20 per cent more than STDC is usually sufficient to encourage the use of air freight. In exceptional cases (e.g., TV tubes), the figure may reach 100 per cent.

The actual market area may be plotted for any given air-rate structure. This is demonstrated in Figs 7a and 7b. Fig 7a takes the weight-group 45–100kg and considers the results of the analysis with respect to the standard rate, while 7b deals with the group 500–1,000kg, using a special rate for machinery. In each case the assumption is made that air freight is used only when ATDC equals STDC. This is to simplify the picture, and does, of course, give a conservative result.

For each map current rates are plotted as a series of contours ("isorates") at intervals of 5d per kg. For each consignment the air rates needed to equalize ATDC and STDC are known. We can, therefore, plot against the destination of each consignment the "equality cost." If this figure is equal or less than the ruling rate indicated by the underlying network of isorates, the consignment goes by air. In this way the market area is outlined, and can be finally drawn in as shown. *(To be continued)*

ABBREVIATIONS

FC, freight cost for main section of journey; **PC**, packing cost; **AFC**, air freight cost; **SFC**, surface freight cost; **TDC**, total distribution cost; **ATDC**, air total distribution cost; **STDC**, surface total distribution cost.

Tail-end Charlie at Scampton in this recent Vulcan B.2 study by "Flight" photographer Ian Macdonald

SERVICE AVIATION

Air Force, Naval and Army Flying News

"Ark Royal" Re-commissioned

ON Tuesday of last week HMS *Ark Royal* —described by Admiralty as "the Royal Navy's most powerful aircraft carrier"—re-commissioned at Devonport after a six-month routine refit. She is going to the Mediterranean after post-refit trials and will be the first carrier to have an operational squadron of Wessex helicopters (No 815, whose commissioning was described on this page on July 13).

The carrier, which has been fitted with the most powerful steam catapults in the Navy, will have a total operational complement of 2,300 officers and men. The three other squadrons aboard will be of Scimitars, Sea Vixens and Gannets. In command is Capt D. C. E. F. Gibson, who served in the previous *Ark Royal* as a Naval pilot during the Second World War.

Airborne Coachmakers

MEMBERS of the Worshipful Company of Coachmakers and Coach Harness-makers are to fly from Northolt to Lyneham next Thursday (September 28) in a Comet of RAF Transport Command, as the guests of 216 Sqn. At Lyneham they are to tour the station and attend a formal squadron guest night in the officers' mess, before returning to Northolt the following morning.

This invitation from the squadron follows its adoption by the company at their Court and Livery Dinner in Tallow Chandlers' Hall on June 20. On that occasion (recorded in *Flight* for June 29) the squadron's commanding officer, Wg Cdr N. E. Hoad, and two of the Comet captains were present as guests. 216 Sqn has recently completed 13 million miles' flying all over the world.

Trans-Tasman Record?

IT was recorded on this page for July 27 that a Canberra T.13 of the RNZAF had made "what is believed to be the fastest-ever crossing of the Tasman Sea," flying from overhead RAAF Richmond, near Sydney, to overhead Ohakea—a distance of 1,210 miles—in 2hr 18min.

Now an RAAF navigator, Fg Off W. Henderson, writes from Butterworth in Malaya to say that this speed has been bettered by a Canberra Mk 20 of the RAAF. Piloted by Flt Lt A. Barnes and while *en route* to Ohakea on a "Lone Ranger" flight, this aircraft made the crossing from RAAF Amberley, near Brisbane, to overhead Ohakea in 2hr 15min—covering 1,359 miles at an average speed of 649.6 m.p.h.

North American Shackletons

TWO Shackletons of 201 Sqn left St Mawgan on September 11 on a liaison and training mission to Canada and the United States; one is returning there next Monday (September 25) and the other on September 30.

The detachment has been led by the AOC 19 Group, AVM L. W. C. Bower, with the station commander at St Mawgan, Gp Capt E. F. J. Odoire, as his deputy. The CO of 201 Sqn, Wg Cdr R. B. Roache, has also been with the Shackletons.

The aircraft were spending a week at RCAF Comox, on Vancouver Island, participating in maritime air exercises with the Royal Canadian Air Force. On the return journey AVM Bower was calling at the USN Air Station at Norfolk, Virginia, to visit Admiral Robert L. Dennison, NATO Supreme Commander Atlantic.

IN BRIEF

An Australian-built Avon Sabre, now with 3 Sqn at Butterworth in Malaya, has completed 1,000 hours' flying. It was built in 1956. The aircraft, 951, completed its thousand hours flown by the youngest pilot in the squadron, Plt Off I. Edwards.

Two trophies awarded annually by the Argentine Air Force, to the top cadet graduating from Cranwell or Henlow or to the aircraft or administrative apprentice passing out with the highest aggregate marks, are being presented next Thursday (September 28). The senior trophy, a sword, goes to Fg Off Norman Bonnor, who was trained as a navigator at Cranwell and is now on a navigator's course at Gaydon. The junior trophy, a gold medal, goes to Tech Cdt John Swindon, who as an aircraft apprentice at Halton won a prize scholarship to Henlow.

Air Chief Marshal Sir Edmund C. Hudleston, VCAS (centre), being received at the officers' mess at Northwood on the occasion of the recent No 1 Maritime HQ Unit cocktail party. With him are (right) the AOC-in-C Coastal Command, Air Marshal Sir Edward Chilton, and the unit's Commanding Officer, Wg Cdr A. R. Poole

Correspondence

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. Names and addresses of writers, not for publication in detail, must in all cases accompany letters.

ATLB Hearings: a US Reaction

IT may be of interest to you to hear some transatlantic reactions to your reports of the ATLB public meetings. I have become an avid reader of these accounts, and find them extremely entertaining at the same time that they are revealing. It strikes me that British commercial aviation affairs have come to a devilish odd state. As someone in the hearings remarked, there is a coloured gentleman in the woodpile somewhere, and a dark one at that.

First, while the Act is supposedly designed to help British aviation, the only positive result I have noticed to date is that just down the road the fellows at Boeing are now selling 707s to two British lines instead of one. Also conspicuous at Renton is a glittering 707 for Ubangi Airlines' new New York - Timbuktu service via London.

Then, in the midst of the barrage of applications for scheduled services from the independents (once, I believe, usually called "the charter companies"), comes the announcement that the national scheduled airline has earned a cool 4.7m pounds on charter business! Equally remarkable, it seems, is the arrangement whereby a one-time "charter company" operates L-749 cargo services for BOAC, while the latter flies charter—yet also flies *some* cargo services with DC-7Fs. Standardization?

On the topic of equipment, I thought it rather poor taste for the operator of non-pressurized, war-surplus DC-3s and DC-4s (even if the latter do have LST doors welded on the front) to refer to someone else's pressurized, post-war Hermes as "old-fashioned tricycles." This is particularly nasty when you happen to have sold them these same airplanes (and I believe Airwork, now BUA, *did* sell Silver City these very Hermes).

Surely it is only in England that hearings of this sort could be punctuated by incidents like the one involving "Mr Mekie's bread." I hope the hearings are ultimately as beneficial as they now appear witty.

Seattle, Wash PETER J. READ

Overseas Aviation and the Board

IN your recent leading article about "The Independents' Public Image" (August 24) you were, I think, rather unfair to the Air Transport Licensing Board. You said that Overseas Aviation (CI) Ltd went into liquidation within a fortnight of inaugurating an air service duly licensed by the Board, and that the Board had "conspicuously failed in its duty" to satisfy itself about the airline's financial resources.

The licence to which you were referring was presumably for the short-lived service Gatwick - Manchester - Prestwick; in fact, this was a "transitional" licence issued by the Minister on the recommendation of the old Air Transport Advisory Council. It is true that the Board had issued Overseas a small number of other licences for inclusive-tour charters and so on, but not one for a scheduled service. There is no doubt that the Overseas affair has brought home to everyone the importance of the need to ensure that applicants for new services have the resources to carry them out, and I think we will find that the Board is well aware of this point.

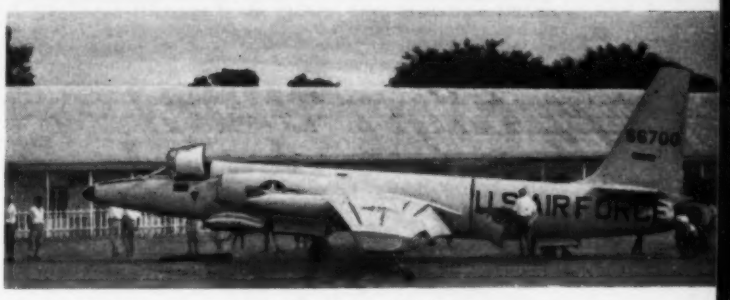
Paris 16e R. PRIEFF-SMITH

U-2 Close-up

THE enclosed photographs [reproduced above—Ed] of a Lockheed U-2 may interest you. This aircraft was photographed by me at Nadi, Fiji, as it passed through on its way to the USA from conducting upper-air sampling tests from Sale in Victoria, Australia.

The sampler box can be seen (in the side-view) under the air intake and offset to port. Note that this aircraft has pinion fuel tanks fitted for extra-long-range cruising. It was one of three based at Sale. They were escorted by four RB-57Bs and supported by a flock of Globemasters. The original negatives are Kodacolor, which unfortunately causes a slight loss of definition when printed black and white. This aircraft was painted mid-grey, whereas the other two were polished metal and did not have pinion tanks.

Darling Point, NSW N. B. WILTSHIRE



The two U-2 photographs referred to by Mr N. B. Wiltshire

Independents in the News

AS a regular air traveller I have been most interested to see how every unfortunate incident—however trivial—involving an independent airline comes under the spotlight of publicity, yet the delays and indifferent service of the State-owned airlines hardly ever seem to warrant a comment.

I suppose the reason must be that it is, of course, not news when the nationalized airlines make a hash of things—because this is what air travellers in Britain have come to expect as "the norm."

Cobham, Surrey ALLAN ROBERTSON

[BEA's regularity in 1960-61—the proportion of flights completed to flights scheduled—was 97.2 per cent, and 77.8 per cent of all their flights arrived punctually. BOAC's regularity in the same period was 98.1 per cent. The independents do not publish figures for regularity or punctuality—Ed.]

More Veterans for Farnborough?

LIKE thousands of others, I was delighted to see the SE5A at Farnborough this year. I wonder if your printing an earlier letter of mine had anything to do with it?

Next year should be a great one with all the new machines, and if the Shuttleworth Trust and the Royal Aero Club and others were to exhibit their historic aircraft in a separate static park, and were later to fly the airworthy examples—making a small extra charge of say, a shilling—I am sure that at least 100,000 of the 300,000 visitors would pay just to get near them. This would mean £5,000 of revenue and a lot of pleasure to a lot of people.

Emsworth, Hants F. HONEY

R/T Patter

FROM the preliminary report on a recent serious airliner accident it seems possible that the use of the word "Roger" may have made the exact position of the aircraft even more uncertain. The methods of use of this word by professional pilots make one wonder just how many appreciate that it is, in fact, an abbreviated way of saying "Your last transmission or message received and understood." Yet we still hear "That is Roger" instead of "That is correct," or the reply "Roger" in answer to some query when the individual concerned presumably means "Affirmative." Then there is the "Roger Wilco" addict, who obviously doesn't know the real meaning of either word.

A more serious howler comes from the fellow who calls (for example) "Chepstow this time," forcing the airways controller to look up at his clock (thereby increasing *his* workload) and making the time, say, 00.33. The chances are that Chepstow was, in fact, passed at 00.31, a couple of minutes having elapsed during the adjustment of ETAs and headings. The required time-separation between aircraft may not be there, and the fact that the one behind

CORRESPONDENCE...

is catching up the one ahead may not show up. If the next sector is a sixty-mile leg—as it is between Chepstow and Weymouth—it may be found that the aircraft will arrive within five minutes of each other, so that one is obliged to change its flight level or slow down, much to the irritation of all concerned.

So many howlers have arisen from the terms VMC, VFR, IMC and IFR that one needs to permutate all the possibilities in order to appreciate the joke fully.

Finally, no reference to R/T would be complete without a dishonourable mention of "one-two-six-seven," the London FIR frequency. At times one doubts the usefulness of reporting on this frequency for getting an airways-joining clearance. Flight information is supposed to be available, but if there does happen to be another aircraft in your locality the chances are you won't be advised. Your only hope is to pick up any position reports that are made, but with the constant babble that endures throughout the summer months it's a matter of luck whether or not the information is heard in time to be of use. A lot would appear to depend on the individual FIR controllers, but one can hardly wonder at the lack of interest frequently apparent when the vast area covered by this one frequency is considered. As for the chap who asks for "descent clearance" on 126.7 Mc/s, it's time he realized that the only clearances in the FIR are strictly meteorological.

Rhoose, Glam — B. A. SPARROW (Capt B. A. Sparrow, FRMetS)

BEA Pionair Disposal

WITH reference to your news-item about the BEA Pionairs, on page 279 of the issue of August 31, a few useful additional points can be made.

The first relates to G-AGZB, which was *not* written off in its crash at Elmdon but was sold to East Anglian Flying Services "as is" (or should I say "as was"?) on December 8 last. It was delivered to BKS at Southend by road on January 8 and entered service with EAFS on April 21 this year, making their total of Pionairs six.

The second point relates to those aircraft whose disposal is under agents' names. The aircraft appearing under the name of F. J. & D. Mann & Co Ltd is being used by the Exeter-based Westpoint Aviation; the two for Fields have been sold to Ghana Airlines; and those for International Development Finance Corp are in service with Silver City.

One final aircraft of the fleet of 38 Pionairs was sold a year before any others, when G-AGJW went to BOAC Associated Companies Ltd on December 8 for the use of Ghana Airlines.

So ends the saga of the Pionairs, the fleet having flown—including pre-BEA service, in most cases a fairly small amount—the best part of three-quarters of a million hours.

London NW6 — JOHN M. DAVIS

More Dogmatism

I AM writing concerning the recent correspondence about dogs and flying. The letter of Mr Kaye-Nein is in my opinion quite right; and as by my researches on the development of aviation, especially in World War One, I have had so often occasion to study how dogs like aircraft and flying, so I may tell you a little of these things. Recently I obtained a pretty batch of albums from a man who in World War One flew as observer with different Flying Sections, later, in March 1918, becoming Commander of the Schlachtstaffelgruppe D. He went back to the Luftwaffe in 1934 and lives now as Generalmajor (ret.) in Western Germany. I have studied his ten albums and over and over again I found dogs, dogs, dogs!

One photo shows quite clearly this former 1st Lt Missfelder in the observer seat of his Albatros C I at Flying Section 58 with his pilot Lt Poser, and beside him is sitting his dachshund "Waldmann," who makes a really pleasant face!

In these albums are dozens of pictures which show that almost all German flying officers had dogs. I have also another shot of the ace Lt Collin playing with his dog. Ernst von Althaus had his "Mousse," and, as I learnt also, this dog made some flights. Manfred von Richthofen himself tells that his "Moritz" flew. And finally by my own experience I may report that, when I flew in an Argonaut from Berlin to Klagenfurt (Austria) a dog was on board. So long as its master was present it was quiet and pleasant. I have come to the conclusion that every dog likes to fly. It is only necessary that his master is near to him.

Berlin, Germany — HEINZ J. NOWARRA

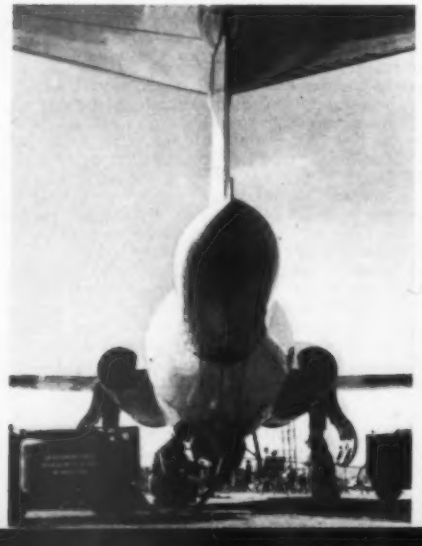
P.S.—I have just found a remarkable event. June 27, 1917, a DFW CV, marked 39 on side of fuselage, with the crew Lt Böttcher, Cpl Reichelt of Schutzstaffel 12 (Escort Squad) started, accompanied by Lt Böttcher's dachshund, from airfield Faumont. This plane fell in aerial combat over Avion. So the dog fell together with his master.

FORTHCOMING EVENTS

Sept	23-24	International Grand Prix for Light Aircraft, Bourges.
Sept	25-29	RAeS: Symposium on Crack Propagation.
Sept	27	Kronfeld Club: USAF Film Evening.
Sept	27	RAeS Graduates' and Students' Section: Film Show.
Oct	2-7	12th International Astronautical Congress, Washington DC.
Oct	4	BritIRE: "Methods Used for the Study of Vibration in Aero Engines," by D. A. Drew.
Oct	4	Kronfeld Club: Debate on "Gliding should be Government Subsidized."
Oct	5	International Airline Navigators Council: Pacific Regional Meeting, San Francisco.
Oct	5-6	Aerodrome Owners Association (Leeds and Bradford): Conference, Harrogate.
Oct	6	RAeS Rotorcraft Section: "Integrated Flight Systems for Multi-engined Rotorcraft Transports," by N. Sullivan, J. A. Simpson and a US representative.
Oct	7	Kronfeld Club: Annual Dinner and Dance.
Oct	7-8	Genoa Rally.
Oct	10	RAeS (Luton Branch): Film Evening.
Oct	11	BritIRE (South Western Section): "General Introduction to Inertial Navigation," by R. Collinson, and "Components and Techniques Employed in Inertial Navigation Systems," by E. Bristow.
Oct	11	Kronfeld Club: USAF Film Evening.
Oct	11	RAeS Agricultural Aviation Group: "Agricultural Aviation in New Zealand," by G. G. Lindsay.
Oct	12	RAeS (main lecture at Isle of Wight Branch): "Experiences in Constructing and Flying Bell's Recent VTO Aircraft," by J. O'Malley Jr.

FOR THE BUCCANEER'S HIGH-ALTITUDE INTERLUDES

One of the many British military and civil aeroplanes equipped with a liquid-oxygen breathing system is the Blackburn Buccaneer S.1. These photographs, taken during the recent SBAC Display, show the system being replenished from a British Oxygen Aviation Services 75-litre dispenser, via the company's new coupling which incorporates a gas bleed to prevent any freezing



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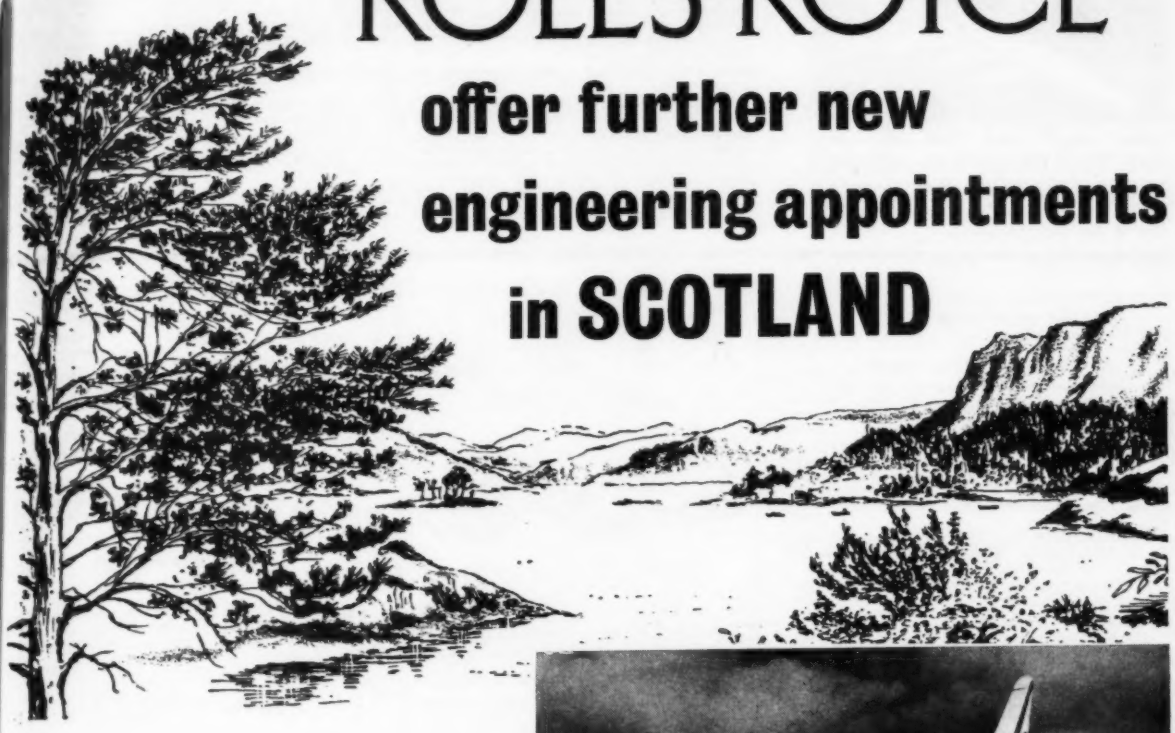

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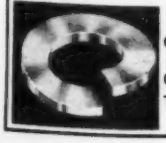

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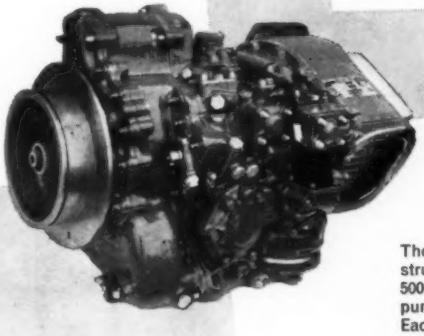

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